SCIENTIFIC AMERICAN

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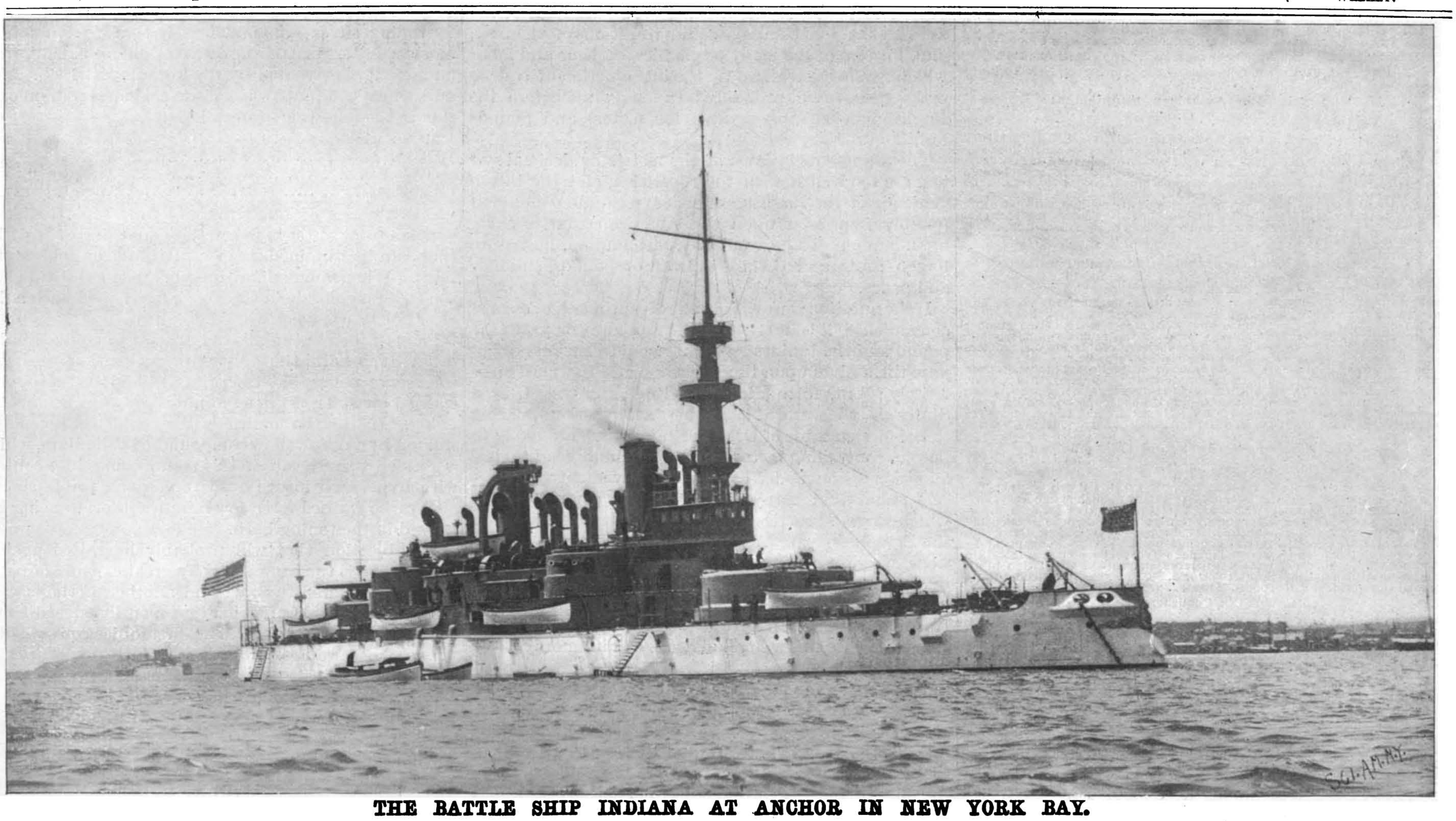

THE BATTLE SHIP INDIANA AT ANCHOR IN NEW YORK BAY.

THE INDIANA—FORWARD TURRET, LOOKING AFT FROM THE BOW.—[See page 156.]

Scientific American.

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NEW YORK, SATURDAY, AUGUST 15, 1896.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 1076.

For the Week Ending August 15, 1896.

Price 10 cents. For sale by all newsdealers.

THE METRIC SYSTEM OF WEIGHTS AND MEASURES.

There is a question being agitated just now in England which is of great commercial importance to that country, and may become so, at an early day, to the United States. We refer to the movement in favor of adopting the metric system of weights and measures in place of the cumbersome and confusing tables at present in use. The agitation has progressed as far as the introduction of a bill before Parliament, making the use of the system compulsory after a specified length of time. It has met the opposition which was to be expected from a people who have a strong sentimental attachment to the usages and traditions of the past, and, in spite of the many economies of time and labor which would be realized by the introduction of a decimal system, it will probably be a long while before the Englishman exchanges yards for meters and pounds for kilogrammes.

The arguments in favor of the metric or decimal system are too well known for repetition, and the inconvenience of the English system of reckoning money is forcibly impressed upon the American tourist when, upon landing at Liverpool or Southampton, he has to forego cents and dollars in favor of pounds, shillings and pence.

If the question were simply one of sentiment, or even of convenience, it is likely that the foot and the yard, the pound and the hundred weight, would continue to impose themselves upon the workshop and the mart indefinitely; but fortunately for England, the United States and the world at large, there are questions relating to the foreign trade of Great Britain which are likely to be the controlling factor in the case, and lead to her adoption of the modern and more convenient system.

It seems that many of the foreign countries with which England carries on an extensive trade are using the French system. As matters now stand, the dimensions, weights, etc., of the machinery which is purchased by the South American states, for instance, is expressed in terms of measurement with which they are not familiar. It would seem at first thought that this difference of measurements was a small matter, requiring only a few minutes' calculation; but it appears to have proved the decisive factor in German and English competition, these foreign countries in many cases preferring to purchase their machinery from a country which expressed its dimensions and value in familiar terms. Of course, the German manufacturers have not been slow to make the most of this slight difference in their favor; and a large part of the decrease in English foreign trade with certain countries is attributed by the manufacturers directly to this cause.

If this be true, and there is no reason to doubt it, we may look for an early adoption of the metric system in Great Britain; for sentimental and conservative as they may be, they are too practical a people, especially in all matters affecting their supremacy in trade, to allow a long established but cumbersome custom to prove a stumbling block to the continued advancement of their commercial interests.

Side by side with the many admirable institutions which our forefathers brought over from the mother country, there are some that] had better have been left behind; and conspicuous among these is our present system of weights and measures, which is practically the same as that of Great Britain. We are keenly alive to the disadvantages of the system, because side by side with it we are using a decimal system of coinage, and the defects of the one are emphasized by the speed and convenience of the other.

The arguments in favor of the metric system for England are equally strong, or soon will be, as applied to the United States; for although our foreign trade does not approach the volume of British foreign trade, it is likely that in the course of time it will do so, and even exceed it. Prudence would suggest that we should avoid the dilemma in which the English manufacturers find themselves, by making an early change to the metric system. Our present weights and measures have no special claim upon our regard. They are ours by inheritance, not by choice, and any temporary inconvenience which might be experienced in making the change would be amply compensated by the subsequent saving in time and trouble, and the avoidance of the serious handicap to which we shall otherwise be subjected in the markets of the world.

New York Rapid Transit.

Rapid transit in New York City has taken an important step forward in the decision of the commission to reject the plan of Messrs. Gould and Sage for the extension of the elevated railway system by a system of surface roads. The commission announces that it has no power to authorize the Manhattan Elevated Railroad Company to build a surface road north of the Harlem River, as they proposed to do at a recent meeting of the Commission. At the same time the engineer of the board was instructed to draw up plans, at as early a date as possible, for a system which will be practically the same as that recently suggested by him to the board, the details of which will be found in our issue of August 1; the chief difference being that the limit of cost is put at $30,000,000 in place of the $26,000,000 mentioned in the engineer's report. As the figure represents only 60 per cent of the limit imposed by the law, there can be no objection to the scheme on the ground of cost; and the fact that the elevated road's proposal is rejected very much simplifies a question which ought to secure the support of all who have the welfare of the metropolis at heart.

Palladium Toning.

BY A. A. KELLY AND H. HUMLY.

We have recently been making a few experiments as to the suitability of this member of the platinum group for toning silver prints. The salt that we found to be most useful for this purpose was the chloro-palladinite of potassium, represented by the formula K_2PDCl_4. This salt, when combined with citric acid and sodium chloride in the following proportions:

Potassium chloro-palladinite	5 grains
Sodium chloride	50 "
Citric acid	50 "
Distilled water	25 ounces

yields a series of tones ranging from sepia to black, which are far softer in effect than anything of the kind that can be obtained from a platinum or gold toning bath. When ammonium molybdate is substituted for the sodium chloride in the above mentioned bath a fine chestnut brown color will be obtained.

Prints toned in the above bath are to be fixed in the usual hypo bath, the only extra precaution necessary to observe being that the prints should be thoroughly washed for at least fifteen minutes between toning and fixing. If this be omitted, they will be hopelessly stained by a deep yellow compound of palladium, which is formed when a salt of this metal comes into contact with hypo. To insure even toning the prints should always be washed for a few minutes prior to being immersed in the toning bath.

An objection that will probably be raised against this process is the comparatively great expense of palladium as compared to gold; and another, perhaps, that the particular salt of palladium mentioned is difficult to obtain commercially. The first objection will disappear when we remember that a bath made up with the palladium salt will tone at least twice as many prints as a bath containing an equivalent amount of gold, and, at the same time, that while gold chloride costs 1s. 9d. per tube of 15 grains, the same quantity of chloro-palladinite will only cost a penny more.

As to the difficulty of obtaining the chloro-palladinite, this should not be a serious obstacle to any amateur who possesses a slight knowledge of chemistry.

In brief, the process of preparing it is this: Take 1 drachm of palladium chloride and dissolve it in half an ounce of pure hydrochloric acid, then 50 grains of chloride of potassium is taken and dissolved in half an ounce of distilled water. The two solutions are then mixed together and evaporated to dryness on a water bath—a piece of apparatus that may be easily extemporized by taking a 4 pound golden sirup tin, half filling it with water, and placing an ordinary saucer on top in place of the lid. The solution to be evaporated is then placed in the saucer and the whole apparatus is stood either on a spirit stove or on a tripod above a Bunsen burner, and the water allowed to boil until the solution in the saucer dries up. The residue on the saucer will be the chloro-palladinite of potassium, and is in the form of a brown crystalline powder.

The palladium chloride may be purchased in quantities of 15 grains and upward at most of the big dealers in apparatus and chemicals at about 13s. per drachm, from which the cost of the finished chloro-palladinite works out at about 1s. 10d. per 15 grains.

In conclusion, we think that anyone who follows out carefully our directions in trying this process will obtain very satisfactory results.—Photographic News.

Testing Quicksand.

Suppose we take a certain quantity of quicksand, dry it artificially, and then try to make it into quicksand again. Put it into a box and pour water on it carefully. Instantly the water is soaked up, and if we measure the volume, or better, the weight, of the sand, we shall see that it takes up a quantity of water that measures 30 per cent of its own volume, or 20 per cent by weight. The rest stays above the layer of sand. If we now pierce a little hole in the bottom of the box, we shall see pure water run out; the sand forms a kind of immovable filter. Also by turning the box upside down we see the sand keep its form like a stopper. It follows from this experiment that we cannot obtain quicksand in this way. We must reverse the condition of the experiment. Let us put the water into a vessel and sift in the dry sand in a thin stream, while shaking the vessel lightly. Then we shall get the thick but easily flowing compound known as quicksand. That the mixture may keep its mobility two conditions are necessary: 1. The quantity of water contained must not be less than 21 per cent by weight. 2. The whole must be continually though lightly shaken. If we increase the proportion or interrupt the agitation for an instant, the mass settles down, retaining about 20 per cent of water, while the surplus, if it exists, rises to the top.—La Nature, Paris.

The Making of Mammoth Cave.

BY HORACE C. HOVEY.

Hardly any other cavern has been so repeatedly described as the Mammoth Cave of Kentucky. Its bibliography includes more than 400 recorded titles of books, pamphlets, magazine articles and excerpts from scientific proceedings. Among this mass of literary material there is a guide manual and map, published about fifteen years ago by the writer of this article, and recognized as of standard authority by the managers of the cave. The time has come for a new manual, and in preparing it I have gone over the ground again, with the expert co-operation of Dr. R. Ellsworth Call. Between us every avenue, room, pit and dome of the vast cavern has been re-explored (with one or two exceptions), there being more than 200 in all. Among the many things to which our attention was directed was the vexed problem of cave making. Almost every writer, popular or scientific, mentions two causes as particularly active; namely, the disturbance of strata by earthquakes and the grinding force of pebbles and sand by whirling water. Our conclusion is that neither of these agencies had much to do with making the Mammoth Cave.

Limestone caves form a class by themselves, unlike those in lava, basalt, granite or sandstone. But they also differ greatly among themselves. Some of them have undoubtedly been subjected to repeated seismic action, like the fractured and cemented rocks of Virginia; whereas the limestones of Kentucky are remarkably homogeneous, and show hardly any signs of disturbance from their primitive condition. The entire region has been carved into its present shape by simple erosion. Imagine a vast plain covering fully 8,000 square miles, slowly and gently uplifted, and meanwhile subjected to the chemical and mechanical action of air and water; and the result would be such an area as that in the heart of which Mammoth Cave and many similar caverns are found. The surface now is undulating, with thousands of "knobs" and "sink holes;" the former being eminences, some of them several hundred feet high, often in the shape of symmetrical cones, left by the wearing away of the weaker rocks, the original strata being undisturbed even to the very apex; and the latter being oval depressions of various sizes, without inlet or outlet, except through funnels communicating with underlying caverns.

On leaving the Louisville & Nashville Railroad, at Glasgow Junction, we are in Edmondson County, with its 4,000 sink holes and 500 open caverns—a cave hunter's paradise, only imperfectly explored and inviting further research. Following the spur track that runs to Mammoth Cave, and passing several rival attractions, we skirt the margin of Eden Valley, adorned by fertile farms that are flanked by the virgin forest. This, instead of being a true valley, is really an enormous sink hole, probably due to the falling in of some immense cavern. Beyond it we soon approach Mammoth Cave and its associated group of grottoes, all drained into Green River, which is the only openly running stream in all that region.

In general terms, the Mammoth Cave may be described as a congeries of caves and grottoes of various sizes and levels, whose walls and floors have been worn thin and finally broken down, thus making one vast labyrinth. The explorer cannot tell to what huge chambers he may be admitted by some small aperture. And this is one thing that makes even a tentative survey difficult and unsatisfactory, as compared with a similar survey of a surface area.

The occlusion of some of the large avenues is interesting and instructive. Wherever this occurs it shows a falling in of the roof, with a strong presumption that the passageway extends beyond the mass of debris. The original entrance to Mammoth Cave was through what is known as Dixon's Cave, which proceeds with dimensions of surprising magnitude for 1,500 feet, and then abruptly ends in a pile of rocky fragments mixed with clay, making a hill about a hundred feet high. Shortly beyond this is the present entrance, which is plainly due to a breaking down of the cavern roof. Following the main cave for perhaps two miles we reach the cataracts, where, at times, the water descends in great volume and force. Just beyond them the roof has been crushed downward by the superincumbent weight, showing the strata in sweeping reversed arches—the only place in this cave where such a phenomenon is observed. Going on through several grand enlargements, one of which as measured is 500 feet long, 300 feet wide and estimated to be 130 feet high, we see myriads of rocky fragments, by many supposed to have been due to the action of earthquakes. But as the strata overhead show no signs of fracture, even where the rocky canopy covers two acres by one block of limestone, as in the great hall just mentioned, we explain the fallen fragments wholly by aqueous agency. The main cave ends in an occlusion of debris. A similar mass is found at the end of the Audubon Avenue, and others appear elsewhere. The fact that the limestone from which the cave is excavated is overlaid by sandstone accounts for the paucity of stalagmites, as compared with the neighboring White Cave, and many other smaller grottoes. And this, indeed, helps to explain the bigness of Mammoth Cave. It is big because never obliterated by the causes that commonly work to destroy subterranean passages.

Pits and domes played an important part [illegible] do so, in the making of Mammoth Cave. It [illegible] be understood that these terms are identical. Vertical shafts seen from above are called pits, but domes if seen from below. Following Dawkins, Shaler and other eminent authorities, we have been accustomed to regard these as irregular tubes cut down from the highest to the lowest level, by whirling water, using pebbles and sand for teeth. But we are now convinced that this theory is untenable. Were it correct, the pits should be wider at the top than at the bottom; but in every case it is otherwise. A small crevice five feet across may expand into a dome several hundred feet in diameter. There is water in most of these shafts, but it trickles down the sides, or flows along the floor, and not a sign appears of its having ever been "whirled about with pebbles for teeth," as is stated by Prof. Shaler. The grooving is invariably vertical, with no marks of boring, drilling or grinding. We examined minutely many small domes formed on exactly the same plan as the larger ones. In every instance their arch was solid, except for the narrow aperture through which water gently flowed. On the floors of some of them were pebbly basins, but in others not a pebble or a grain of sand was visible. All the great pits extend down to the drainage level, and contain standing or running water, sometimes quite a rapid stream, but no whirlpools.

Our conclusion is that the typical domes have resulted from simple solution by the agency of acidulated water. In proof of this we found, in Gorin's Dome, Lucy's Dome, and elsewhere, masses of limestone, both fallen and in place, that seemed solid and firm, but that crumbled to fragments or yielded like putty under the hand. This, indeed, is such an element of danger that Manager Ganter had his men go to the summit of Gorin's Dome with sledge hammers, and break down the edges until they came to sufficiently solid rock to support the timbers of the new bridge he is building there, and from which one of the finest cave scenes in the world will be made visible to the tourist. On inspection, the limestone is found to be highly oolitic, hence its friability when the round, egg-like particles of which it is composed are set free by the dissolving of the cement that holds them together. These particles, rolling down with the trickling water, would naturally carve just such vertical grooves as actually exist. We may add that much of what has been mistaken for sand is really comminuted limestone. Great banks of it are sometimes found, and elsewhere true silicious sand exists, but not as an agent in cutting the domes.

Such exaggerated statements have been made as to the dimensions of the domes and pits, that we took pains to sound them all. We began with the well known Crevice Pit, in Little Bat Avenue, that opens into the Mammoth Dome. Lee's map, published in 1835, and claiming to be made by instrumental survey, makes this pit 280 feet deep, or "120 feet lower than the bed of Green River." The shelving edges of this ugly black hole make an approach dangerous. There are also projecting shelves below and out of sight, on which, unless one is careful, his plummet is liable to lodge, the weight of the line causing it to continue to be paid out, a circumstance that probably deceived Mr. Lee and others, as it did ourselves more than once. We made three measurements of the Crevice Pit; one was by ordinary line and plummet; another was by tying a large stone to the line, as a bob that would jump the ledges, and make it impossible to mistake the paying out of the line for the pull of the weight; the third way was by attaching a lard oil lamp by wires to the line, and watching the light till it reached the bottom. Finally, by going around through Spark's Avenue to the Mammoth Dome, we made sure that our weights had properly landed.

The line was then measured by a steel tape, the result being that the pit is 89 feet deep, instead of 280. Even if we add to this the estimated height of Klett's Dome, the entire vertical opening cannot exceed 150 feet. I am thus minute as to methods, because we took similar pains in measuring the other pits. There is no question as to the peril of the task. The depths of some of the pits may here be given, as determined either by Dr. Call, Mr. Ben Hains, or myself.

The so-called bottomless pit, as measured by me, is exactly 105 feet deep, although commonly said to be 173 feet in depth. The covered pit, instead of being 120 feet, as formerly stated, was found to be but 54 feet deep. Garvin's pit is 95 feet deep, with a dome above it 35 feet high. My measurement of Scylla made it 135 feet deep; but I suspect that slack line was paid out, as its twin pit, Charybdis, was proved to be but 89 feet deep. Dropping a line from the "window" of Gorin's Dome, where tourists usually look, I found it 88 feet down to the floor. From the new bridge across the summit of the dome it was 105 feet to the stream flowing at the bottom. While thus casting my lines from above, Dr. Call and his guide went down a sort of natural well and saw that my weights had touched the floor. They then distributed lamps at advantageous points, as we did from above; and the guides flung numerous fireballs, with great skill, so as to alight on different ledges. Thus we contrived to illuminate the entire dome, as it had never been done before, and the effect was splendid beyond description. The Long Route ends in a pit called the Maelstrom, stated to be 190 feet deep by W. C. Prentice, who descended into it, and 175 feet by Dr. Forwood. But as measured by Mr. Hains, by a cord knotted at every five feet, and allowing for the stretching by the plummet, it is 98 feet deep. We do not question the veracity of others, but allow for their mistakes in taking measurements where the experimenter is liable, by one careless step, to follow his plummet down into the frightful abyss.

The subterranean rivers have, of course, been an important factor in making the Mammoth Cave. One who sees them at their lowest stage in the summer months, and floats over them at leisure, awakening their wonderful echoes, has no idea of their tremendous volume and force during winter and spring. I have been in the cave when the Dead Sea, Lake Lethe, the river Styx, Echo River, and the Roaring River were all combined into a mighty stream fully two miles long, as known, and how much further it flows into inaccessible channels nobody knows. Its depth at such times is at least 100 feet in the deepest places, and it sets back into the large pits already mentioned. Moreover, this great flood has a powerful current that makes any attempt at its navigation dangerous. The guides have told me of their narrow escapes from having their craft swept under overhanging ledges, or swamped where there was no shore. What are called the upper and lower big springs, in the cliffs of Green River, are wholly insufficient to serve as the main exits for these pent-up waters. About five miles below them a mighty stream gushes from the rocks with force enough to stem the current of Green River to its opposite bank; but unfortunately it is on the wrong side of the river, unless passing through a tunnel before it gets there, of which we have no proof. These subterranean rivers are, after all, the chief cave makers. They hollow out the long horizontal passageways, swaying to and fro like liquid battering rams, hammering down the weakened walls, and undermining the arches, thus making the successive tiers, or galleries, for which the cave is noted, many of which, having been deserted by the waters long ago, like the upper gallery called Gothic Avenue, are extremely dry. And yet, even in the walls of these broad avenues, we frequently find the deep vertical grooves, proving that there were also pits and domes, of which these are the only remaining traces. Thus our conclusion is established that Mammoth Cave was made, not by earthquakes, nor by whirlpools with pebbles for teeth, but almost solely by the chemical and mechanical action of water.

Prof. Andrée's Arctic Trip.

Advices received at Hammerfest, Norway, on August 6, say that Prof. Andree has completed the inflating of his balloon, and is awaiting a favorable wind to start on his journey toward the pole.

The following letter has been received from M. Andrée by Prof. Retzius at Stockholm:

PIKE'S HOUSE, DANE'S GATE, June 27.

DEAR FRIEND: At this moment forty pens are scratching on board the Virgo, for to-day a steamer arrived bound to Frefjorden, which is to take our letters. I take this opportunity to tell you and your wife that everything is going on well here. After having searched only one day we found a good spot for our balloon house, and we are now occupied in putting it up. It lies on the northern side of the Danish Islands. We have there sufficient space, good protection against storms, and a good landing place. The hydrogen apparatus has already been put on shore, and with this the most difficult part of the landing has been finished. The barrel of sulphuric acid has held out excellently. We can now examine the balloon a little better, and it seems to be in very good condition. Capt. Nilsen, who since the middle of May has been sailing about here, says for thirty years he has not seen such favorable ice. All on board are in the best spirits. Need I add more to convince you that the whole expedition feels very comfortable, and that no apprehension or care oppresses us? If everything goes on in the same manner for the next three or four weeks to come, we shall then set out for our expedition to the North Pole, and to none of us the idea occurs that we may meet serious difficulties. Strindburg and Eckholm are occupied with magnetical and cartographical examinations, and have begun a map of the Danish Islands. The snow shoes did good service, for they prevented us from sinking in, though the snow is at several spots meters deep.

Rogers Peak Ascended.

A despatch from Glacier, British Columbia, announces the first ascent of Rogers Peak, the highest part of the Hermit Range of the Selkirk Mountains, by Prof. C. E. Fay, of Boston, and his party. This is Prof. Fay's second season among the Canadian Rockies and Selkirks.

THE NIVET APPARATUS FOR TESTING BUILDING MATERIALS.

The testing of building materials is a matter of undoubted importance. The solidity of our structures and our safety may depend upon the care with which such testing is effected. Learned societies and governments themselves have occupied themselves with this important question, and commissioners have been appointed for a study of the conditions under which the tests should be made, in order, if possible, to succeed in unifying the methods employed, and in obtaining concordant results. The tests to which the materials must be submitted require the bringing of great stresses into play. The apparatus used are inconvenient to maneuver, are of great weight and are high priced, and so trial tests are not made so frequently as might be desirable.

In 1895, Mr. Nivet presented to the meeting of the French Association for the Advancement of Sciences an apparatus for testing building materials (other than metals) that constitutes a genuine portable laboratory, and that seems to us to be destined to render valuable services in the testing of lime, cement and stone in workyards. The entire mechanism is contained in a box measuring 13 × 20 inches, and three inches in height, in which also are placed the moulds, F F (Fig. 1), necessary for the preparation of the test pieces. The weight of the apparatus with all the accessories does not exceed 88 pounds.

The measuring device is a Regnier dynamometer (Fig. 2). This instrument consists of an elliptic steel spring, R, upon one branch of which is fixed a divided dial, C. This latter, which our draughtsman has supposed to be transparent in order to allow the details of the parts to be seen, is provided with a needle, a, whose axis carries a toothed wheel, and which meshes with a rack, c, that slides freely in its mounting. One end of this rack is in contact with the spring when the needle is at zero, and the spring is not bent. When the short axis of the spring is compressed through a pull upon the long axis directly, or upon the lugs, e e, the spring exerts a thrust upon the end of the rack, and consequently causes the needle to revolve by a certain number of degrees proportionate to the distortion, that is to say, to the force to be measured.

Since the rack is not fixed to the spring, the needle, when the latter expands, remains in the position that it occupied at the moment at which the force was suppressed or simply diminished. It thus indicates the maximum value of the force that has been applied. Before beginning an experiment it is evidently necessary to place the needle at the zero of graduation by hand. When the short axis is acted upon directly, the dynamometer is very sensitive. It is much less so when we operate by traction upon the long axis. The dial carries two divisions corresponding to these two methods of using the instrument. The figures inscribed upon the dial represent a fifth of the real stresses in order to render it possible to read the weights per square centimeter that determine the breakage of test pieces of five square centimeters section. The results given by test pieces of different section are calculated by means of multiples, a table of which is affixed to the box containing the instrument.

In Mr. Nivet's apparatus, the upper lug of the dynamometer, which acts upon the lower branch of the spring, is hooked to a second lug pivoted through a knife edge upon a lever L (Fig. 1), which is itself pivoted at O upon the frame of the machine. This lever, L, may be rendered stationary by means of a nut, v. The lower piece is connected, according to the operations to be effected, with different parts, as we shall see further along.

The traction is effected by means of a screw, V, maneuvered from the exterior of the box by a handle. This screw carries along the jaw, M, as well as the lugs, E E. It is through the intermedium of this jaw and of these lugs, E E, that the traction is transmitted to the test pieces.

The dynamometer and the different parts of the apparatus rest upon a horizontal cast iron frame that forms a part of the box. The weight of these different parts and of the test pieces themselves is thus annulled and has no influence upon the results.

The apparatus may be used for two series of tests. The first series comprises the traction and compression tests used in laboratories.

Traction.—The test pieces, R, of the materials to be examined have the form of a figure 8, the constricted part of which has a section of 5 square centimeters. In order to perform the experiment, the lever, L, is rendered stationary by means of the nut, v (Fig. 1). The dynamometer is attached at its lower part to the jaw, M'. The test piece is placed between the two jaws, which embrace its periphery. Each jaw is strengthened by a crosspiece, T. Upon slowly revolving the screw, v, a traction is effected whose value at every moment is given by the needle of the dynamometer. When the breakage takes place, the spring abruptly expands, but the needle remains in place and indicates the breaking stress. As the points of suspension and jointing are in a line with the axis of the screw, the stress is transmitted solely in this direction, so that the test piece is submitted to no flexional stress.

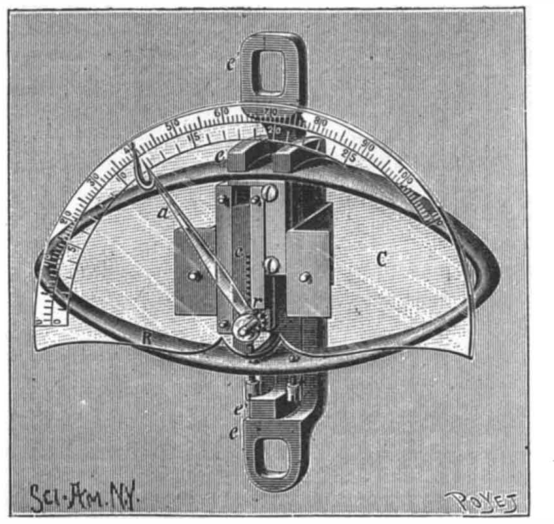


Fig. 2.—DETAILS OF THE DYNAMOMETER.

Compression.—The experiments in crushing are made with tubes whose section is 5 square centimeters, 2·5 square centimeters, or, better, 1 square centimeter. The lever, L, is rendered free (Fig. 1) and the two jaws, M and M', are connected by the metallic piece, A, which has the form of a figure 8.* The test piece is placed between the two plates, P P, one of which rests against the cast iron frame of the box, and the other is movable with the lever, L. The movable plate is placed at such a point of the lever that the pressure shown by the dynamometer shall be multiplied by 5. The plates engage with the frame and lever by conical points that enter conical seats in the larger center. They are, therefore, capable of taking on a certain amplitude of motion, and are not necessarily parallel, like the plates of hydraulic presses. This arrangement permits of correcting the irregularities in the moulding of the test pieces. In employing the press, we have almost always two coefficients of crushing, one called the beginning of crushing and the other the final crushing. The first corresponds to the breakage of too long an edge, and the other is obtained upon a cube already broken and incomplete.

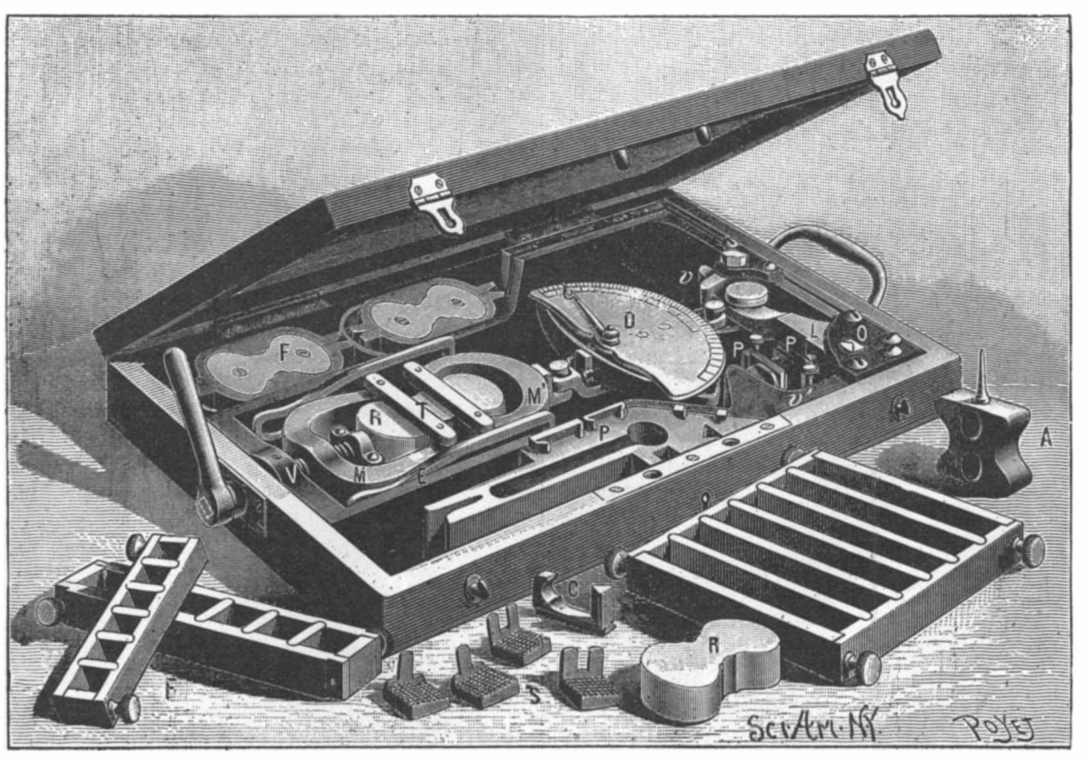


Fig. 1.—NIVET APPARATUS FOR TESTING BUILDING MATERIALS.

In the Nivet apparatus, the needle has but a single stoppage point, which corresponds exactly to the weight that has caused the rupture of equilibrium of the molecules of the compressed solid. Upon continuing to work the screw, we crush the test piece without the needle making a greater pressure. On the contrary, the pressure has diminished, as may be ascertained, if, after having registered the indications given by the needle, we endeavor to push the latter back with the finger. It will stop at a much lower pressure. The lever apparatus completely crushes the solid experimented upon, unless the continuous action of the weight be arrested by an obstacle. The dynamometer, on the contrary, automatically preserves the test piece against such action.

This delicacy of operation permits of studying the cleavages produced by the crushing. Such cleavages generally separate from the cube of the pyramids that have the free faces as a base and a quarter of the sides as a height. As the dynamometer is capable of indicating a pressure of 1,210 pounds, and as the lever multiplies the stress exerted by 5, it is possible to produce between the plates a compression reaching 4,950 pounds that are distributed over the cubes of the different dimensions indicated. The cubes are exactly centered by a play of nuts that are separated when the test pieces are grasped by the plates, the screw having begun to act.

The second series of tests is made by employing a single test piece in the form of a prism with a square base of ¾ × ¾ × 4 inches, upon which the apparatus permits of obtaining as many as nine breakages—one by flexion, two by traction, two by shearing and four by compression.

Flexion.—The breakage test by flexion is made upon the entire test piece. The lever, L, is rendered stationary (Fig. 1); the jaw, M', is suppressed; the test piece is grasped at its two extremities by the lugs, E E, kept at 4 inches from each other, while a piece, C, fixed to the dynamometer and guided by a slide in the frame bends it exactly at the middle. The way in which the breakage occurs shows the defects of the test pieces in homogeneousness when they exhibit dissymetrical breakages.

Traction.—The test piece is divided into two equal fragments by the flexion test. Each of these serves to effect a traction test. To this effect, the dynamometer is connected with the jaw, M', and the small prism is held between two clamps, S. Each of these consists of two quoins connected with each other by a slide at right angles with the parallel faces that grasp the prism, and the inclined faces of which engage between the branches of the jaw. When the screw is revolved, these inclined faces tend to squeeze the faces of the prism so much the more in proportion as the traction is stronger. They thus prevent a sliding, and a breakage by pulling soon takes place. It must be remarked that the pressure exerted upon the solid by the parallel faces of the clamps is at right angles with the axis of traction and consequently has no influence upon the result of the breakage by traction. Moreover, such pressure is relatively feeble, the angle of the inclined planes being very small and the surface that serves to transmit such stress being relatively wide. As the coefficient of breakage by crushing is about ten times that of traction, the pulling occurs before the compression of the prism in the clamps has been able to reach an important value. Such compression can therefore have no influence either upon the actual test or upon the ulterior experiments.

Shearing.—After these tests, the prism is divided into four fragments, the two longer ones of which are selected for experiments in shearing.

The lever, L, is rendered free (Fig. 1), and the two jaws, M and M', are connected by the piece, A. The prism is placed in the square space of a vertical cylinder, H, inserted in the frame of the apparatus in which it revolves with slight friction. The shearing is done by an edge of the lower face of the lever operating through its center. This face moves upon the upper plane that terminates the cylinder carrying the test piece. The shearing will therefore be done exactly according to this plane of insetting of the solid—a condition that we believe is realized only in this apparatus.

Compression.—If we neglect the fragments detached by shearing, we still have four segments of a prism that may be used for tests in crushing.

These tests are made as with the cubes by placing the solids between two plates, P P, that have been previously provided with two punches or disks of metal three-quarters of an inch in width. There is thus seized between the punches a cube inscribed in the prism. Under the pressure of the punches, when the crushing occurs, the cleavages are the same as those obtained with the cubes. The same pyramid is separated in carrying with it the part of the prism that exceeds the width of the punch. There is the same cleavage,

* This piece carries a cylindrical rod having a section of 1 square millimeter, say 1·13 millimeter in diameter, which carries a Vicat needle for setting tests.

consequently the same work, and the same coefficient. The four segments behave like cubes, and, if the material is homogeneous, give results that are sensibly equal.

This second series of tests has the great advantage of permitting all the operations to be effected upon the same solid. One can thus study the relations that may exist between the various coefficients that result therefrom. The precision of the apparatus, in fact, permits not only of verifying the coefficients of quality required by the conditions of a contract for supplies, but also of effecting true scientific researches. Through this apparatus Mr. Nivet has been able to indicate a few laws of the resistance of materials called nonelastic. A study of such work would exceed the limits of this article. We shall add that the tests upon traction and shearing give figures proportional to the sections upon which we operate, while the tests upon crushing give more complex results. In this latter case the coefficient is proportional to the section when the height of the solid tested is equal or superior to the side of the base; but it increases as soon as the ratio of the height to the side of the base diminishes, and becomes infinitely great when the height is very feeble with respect to the base—which is precisely the case with mortar joints. The tests upon crushing must, therefore, be made upon solids whose height is equal to or greater than the side of the base.—La Nature.

New Ocean Record for the American Line.

The American liner St. Louis on her last trip reduced the ocean record from Southampton to New York from 6 days 5 hours 22 minutes, which was the time of her sister ship, the St. Paul, to 6 days 2 hours and 22 minutes. Her average speed was 20·86 knots an hour, which is slightly better than that of the St. Paul, which was 20·82. It is probable that to one of these fine ships will fall the distinction of being the first to bring the time of crossing below six days.

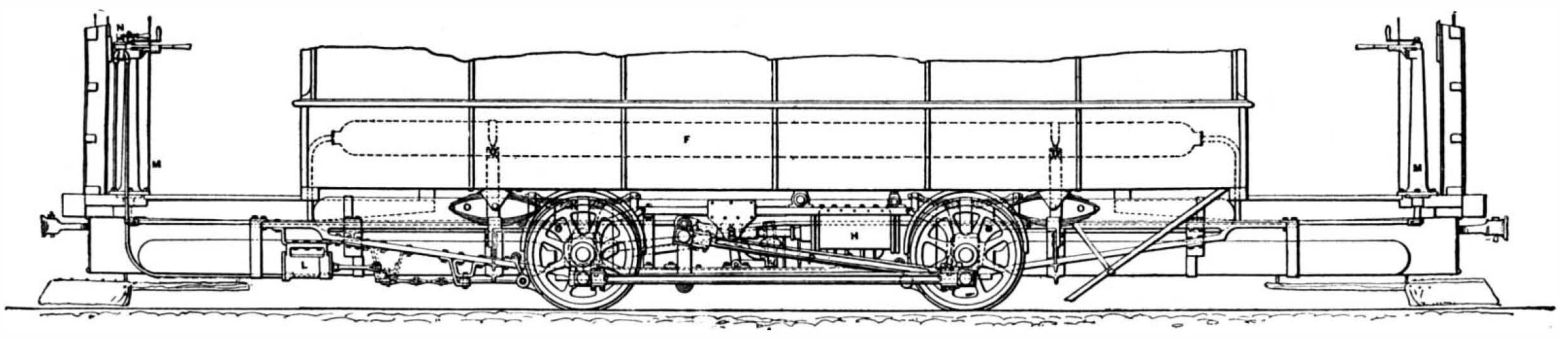
TRIAL OF THE COMPRESSED AIR MOTOR BY THE THIRD AVENUE RAILROAD COMPANY, NEW YORK.

The compressed air motor is a device which is suffering from the prejudice engendered by many years of costly but comparatively fruitless experiment. Invention and capital, seeing its promising possibilities, have frequently joined hands in the effort to produce an efficient motor, but beyond learning some valuable lessons as to the chief sources of loss, and the direction in which improvement must be sought, they have failed to produce an effective machine.

At the present writing, interest in the compressed air motor has been revived by rumors of its adoption by two large corporations: the Metropolitan Traction Company and the Third Avenue Railroad Company, both of New York City; the former making use of the Hoadley motor, and the latter adopting the system invented by Mr. R. Hardie.

The trouble with the earlier systems has been of a twofold nature. When air was compressed into the storage reservoir, a certain portion of the power was expended in raising the temperature of the air (according to the well known law), and this heat, which was subsequently lost by radiation, represented a dead loss of power. Moreover, when the air was expanded in the cylinders, there was a corresponding reduction of temperature, which was often so great as to cause freezing and choking up of the exhaust passages.

In the Hardie system it is sought to prevent the first loss by compressing the air in three stages, and recovering the heat of compression by passing the air through tubes around which cold water is circulating. The cooling water is fed to the boilers and the heat which it has withdrawn from the compressed air is thus recovered. After passing the third stage of compression and cooling, the air is forced at a pressure of 2,000 pounds to the square inch into a reservoir consisting of a stack of rolled steel flasks, 9 inches in diameter and 20 feet long.



SIDE VIEW OF ENGINES AND AIR BRAKE, HARDIE COMPRESSED AIR MOTOR.

THE HARDIE COMPRESSED AIR MOTOR CAR.

The cars, one of which is shown in the accompanying illustration, are similar in their general appearance to an ordinary street car; but they are provided with a truck whose construction is suggestive of the bar frame of a locomotive, the truck, moreover, being suspended by springs from the axle boxes, and the cars being similarly suspended from the truck. Underneath the seats and beneath the floor of the car are sixteen air reservoirs, similar to those in the power house. In the center of the car and also beneath the floor is placed a hot water tank, by means of which the air is heated before it enters the cylinders, and the difficulty of frozen exhaust passages is overcome. It is 18 inches in diameter and 7 feet long, and is filled with 500 pounds of water.

Before the car starts on its run, its air reservoirs are charged with cold air at 2,000 pounds pressure by means of a flexible tube connecting with the power house supply, and steam is admitted to the heater until its contents are raised to a temperature of 350 degrees. It takes a little over half a minute to charge the reservoirs.

In operating the car, the air is first expanded by a reducing valve to a pressure of 150 pounds, and passed into a receiving cylinder, whose capacity is one cubic foot. It is then admitted to the heater, where its action is thus described by General Herman Haupt, the consulting engineer of the company: "When the air passes into the tank of water heated to 350 degrees, each 50 cubic feet of air absorbs and carries over an amount of water in the shape of steam equivalent to 26 cubic feet of air. This adds 50 per cent to the volume; and, as the air is itself expanded 50 per cent by the increase of temperature, the total gain of volume as the air and steam pass from the heater is 100 per cent. The condensation of the steam in the cylinders and pipes liberates the latent heat and maintains the temperature at such a point as to render freezing impossible."

General Haupt informs us that the efficiency of the

heater was tested on a couple of experimental runs, on the first of which, with the heater in use, 308 cubic feet of air were used. The heater was then emptied, and the same run was made with cold air, when more than double the amount, or 661 cubic feet, were required.

The two cylinders of the motor, 7 inches diameter by 14 inches stroke, are built into the frame on each side of the car, and lie inside the wheels. A short connecting rod from the cross head operates a vertical rocking lever, from which a connecting rod transmits the motion to a crank on the outside of the driving wheels. The two wheels on each side are connected by a coupling rod, so that the whole weight of the car is available for adhesion.

The valve gear is of the ordinary Stephenson link type, with an additional valve on the back of the main valve to regulate the cut-off.

The controller and "reverse lever" are situated as in an electric car on the front platform. The throttle valve is operated by a crank handle, and the reversing and cut-off are effected by the lever. There is another lever for working the air brake, by means of which also an auxiliary supply of air can be admitted to the cylinders at starting.

The reciprocating parts are counterbalanced, and this work appears to have been judiciously done, as there is no perceptible oscillation due to this motion. The general appearance of the car is pleasing, the moving parts being hidden from view by letting down the slat apron, which is shown in the illustration hinged back against the side of the car.

Science Notes.

The meteorological and magnetic observatory of the University of Odessa has for its function not only the reading of the numerous instruments with which it is equipped, and the discussion of the results observed and registered, but it is intended also to serve as a high school where students of the faculty of physics and mathematics can be trained in the work of meteorology and physical geography. Schools in meteorology are so few, says Nature, that the development of the curriculum of the Imperial University at Odessa will be welcomed by all who think that trained investigators and experimental work are needed for the advancement of the science.

A paper on "The Application of the Formula of Clapyron to the Melting Point of Benzine" has been printed in the Comptes Rendus by M. R. Demerliac. It records an experimental study of the lowering of the melting point of benzine by pressure. The pressure gage used had been calibrated against a mercury column directly, and the alterations in temperature were measured to 0·001° by the changes in resistance of an iron wire forming an arm of a Wheatstone's bridge. The alteration in melting point for an additional pressure of one atmosphere calculated from Clapyron's formula is 0·02936°; the experimental figure is 0·0294, the difference being less than the errors of observation.

Punctuality in woman has been attained under hypnotic suggestion, in a remarkable set of experiments recently reported to the Society for Psychical Research. A young person of nineteen, who had never shown any capacity for calculation, and who was in good health at the time, though her nerves had been unstrung for a year before, was hypnotized and directed to do certain simple things at specified times, writing down the time when she thought she did them. The intervals suggested varied from a few hundred to over 20,000 minutes, and sometimes as many as six suggestions, starting at different hours, were working on her at once. The experiments read like the painful examples in the mental arithmetics. At 4 o'clock one day she was asked to do something in 10,080 minutes, beginning at 10 the day before. In fifty-five experiments there were only two failures. On awakening, the subject had no recollection of the suggestions made to her.

On the glass of a Crookes tube, which has been used for some time, being heated in the blowpipe, it assumes a dead or dull appearance, which, observed M. Gouy to the Paris Academy of Science, at first leads to the supposition that it has become devitrified. The alteration is, however, limited to the internal surface of the tube, being so much more marked as the glass has received a more intense cathodic radiation, and being absent in the portions not so exposed. The microscope shows that this dull surface is chiefly constituted by a vast number of gaseous bubbles in the substance of the glass, but near its surface. On the heating being continued, these bubbles unite and increase in volume, so that at length they become visible through the magnifying glass, and sometimes even to the naked eye. Glass, therefore, which has been exposed to intense cathodic rays, gives out numerous gas bubbles when softened by heat, a phenomenon which occurs in no other case; and it would seem that the cathodic rays cause the gases of the tube to penetrate into the substance of the glass, afterward remaining occluded until set free by the softening of the glass. The experiments which gave rise to these observations were made with four glass tubes slightly differing one from another, but only one of them showed a considerable number of bubbles in the portions most exposed to the cathodic rays.

THE SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.

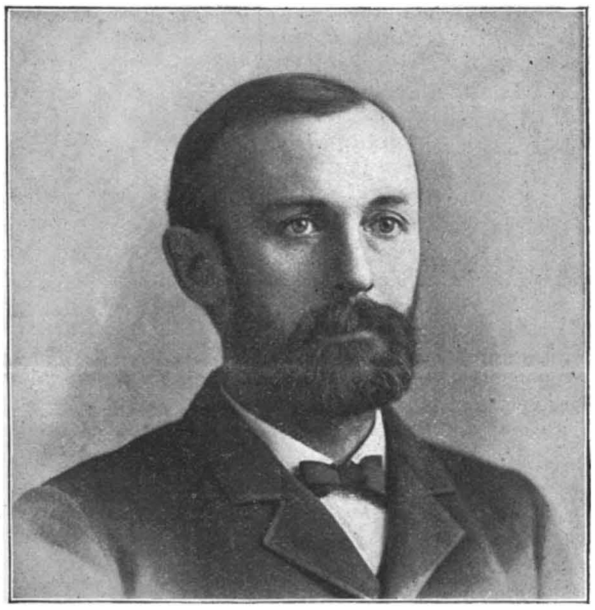
This society is one of those affiliated with the American Association for the Advancement of Science, and will hold its meeting, as usual, a few days before that of the A. A. A. S., namely, from August 20 till August 22, at Buffalo.

The annual address by the president, Prof. Mansfield Merriman, of Lehigh University, will be on "Some Modern Tendencies in Engineering Education."

Dr. Merriman has been an educator for nearly twenty years, beginning at the Sheffield Scientific School of Yale University, soon after his completion of an advanced course of study. He was graduated from the school as bachelor of philosophy in 1871, as civil engineer in 1872, and as doctor of philosophy in 1876, and began teaching in 1877. In 1884 he removed to his present station at Lehigh University, where he is professor of civil engineering. He has been identified with the American Association for the Advancement of Science since 1883, having been elected fellow in 1885, and vice president of the Mechanical Section for the Brooklyn meeting in 1894. His address before that section on "The Resistance of Materials under Impact" is published in the volume of proceedings for that meeting. He has been a prolific writer of text books and essays in his department of science, his latest work having been a volume on higher mathematics, issued during the present month of August, in which Prof. R. S. Woodward was associated with him.

Dr. Merriman was one of the founders of the Society for the Promotion of Engineering Education, which was launched in connection with the memorable mechanical exhibition at the World's Fair in Chicago, so that the society is only three years old.

Its proceedings from year to year have attracted increased attention, and are regarded by engineers as valuable contributions to technical literature. A large number of papers will be read at the approaching session, the interest of the meeting being greatly stimulated by the fact of meeting so near to the wonderfully expanded industrial enterprises which have taken root at Niagara. A great increase in the number of topics presented to the mechanical section of the A. A. A. S. is also promised for the same reason.



MANSFIELD MERRIMAN,

PROFESSOR OF CIVIL ENGINEERING, LEHIGH UNIVERSITY; PRESIDENT OF THE SOCIETY FOR PROMOTION OF ENGINEERING EDUCATION.

Saturday, August 22, will be given up to an excursion to Niagara Falls, under the direction of Mr. George E. Mann, president of the Engineers' Society of Western New York, and every afternoon other excursions will be made.

The programme so far as yet made up includes the following papers to be read on different days: President's address, "Past and Present Tendencies in Modern Engineering Education," Mansfield Merriman; Report of Committee on "Uniformity of Symbols for Engineering Text Books," I. O. Baker, chairman; "Agreement on Definition of Engineering Terms," Thomas Gray; "Seminary Methods as Applied to Engineering Subjects," F. P. Spalding; "An Experiment on the Conduct of Field Practice," F. O. Marvin; "A Quarter Century Progress in Engineering Education," Robert Fletcher; "The Method of Teaching Perspective to Engineering Students," H. S. Jacoby; "The Study of Modern Languages in Engineering Courses," T. M. Drown; "A Course of Study in Naval Architecture," C. H. Peabody; "The Elective System in Engineering Colleges," M. E. Wadsworth; "The Desirability of Lectures to Undergraduates on the Ethics of Engineering," C. C. Brown; "Quantity versus Quality in Smaller Colleges," Albert Kingsbury; "Biology for Civil Engineers," G. C. Whipple; "The Conservation of Government Energy in Promoting Education and Research," C. W. Hall; "The Hale Engineering Experiment Station Bill," W. S. Aldrich; "How to Divide Subjects for Original Investigation among Different Colleges," C. H. Banjamin; Report of Committee on "Entrance Requirements for Engineering Colleges," F. O. Marvin, chairman; "Credit for Shop Experience in Entrance Examinations," W.T. Magruder; "A Course of Study in Municipal and Sanitary Engineering," A. N. Talbot; "Engineering Education in Japan," J. A. L. Waddell; "Modeling as an Aid to Teaching Machine Design," G. W. Bissell; "A Course of Study in Mechanical Railroad Engineering," H. W. Hibbard.

The meeting of the society will be held at the room of the Engineers' Society of Western New York, in the Library building, Buffalo, August 20–22.

Cycle Notes.

For comfort the front tire should be considerably softer than the rear one.

District telegraph boys in New York City have been provided with bicycles.

The bicycle has reached the Soudan; at last accounts there were two in use there.

A room for checking bicycles has been provided at the Metropolitan Museum of Art in New York city.

The Argentine Republic has passed a law forbidding women to ride bicycles in public. The law was framed to protect the interests of the owners of public vehicles.

Riders should never allow the adjusting cone of the head of the wheel to become loose, as continued jolting will thus weaken that part of the wheel, which bears the greatest strain.

A pneumatic grip is one of the latest contrivances to make the trip more enjoyable. Grips provided with a ball joint are also being introduced.

Even to the farthest eastern part of the world the bicycle has found its way. A bicycle club has been formed at Vladivostok, which is the end station of the great Siberian railway, 10,643 kilometers east of St. Petersburg.

A London bicyclist, Mr. Jefferson, who has undertaken to ride to Irkutusk in Siberia, reached Moscow by a roundabout journey of 2,500 miles from Rotterdam in six weeks. He went by way of Hamburg, Dantzig, Riga, St. Petersburg, and Novgorod, and had bad weather, snow storms, and bad roads in March and April.

Bicycle manufacturers are making a large draught on the supply of elmwood. Most of the wood used in the rims of bicycle wheels are now made of rock elm. During this year 3,000,000 rims will be required for the trade. It takes about 2½ feet of wood for a rim, so that the 3,000,000 rims will call for 7,500,000 feet of wood. As only the finest wood can be used in rims, amounting to only a fifth of the bulk of rock elm, these rims will call for the cutting and handling of nearly 40,000,000 feet of this wood.

An inventor of Switzerland has designed a bicycle which he thinks will effect a revolution in the shape and mode of propulsion of the wheel. He proposes to utilize the strength in the back as an aid to the legs in propelling the wheel. The pedals are on a line with the bottom of the seat, and are placed in the front part of the frame. There is a back to the seat which affords a brace for the rider's back, enabling him to exert much more power than in the present model. The steering bar consists of a long handle similar to that of children's tricycles.

It is not surprising that some of the leading features of bicycle construction should be traced back for centuries. The invention of the pedals has been attributed equally to a Frenchman, Michaux, to a Scotchman, and to a German, according to one's nationality, but it seems that none of them can have the honor of priority to this method of propulsion, for according to a book published in 1694, under the title of "Recreations Mathematiques et Physiques," the inventor was a doctor named Elie Richard, living at Saintonge. It appears that in 1690 he constructed a carriage which was driven from behind by a footman, "who worked it with two feet by means of two little wheels concealed in a box, and attached to the axle."

Wooden handle-bars are considerably in vogue just now and promise to gain rapidly in favor. Indeed, the prediction is ventured that in a year or two they will displace the metallic ones as completely as wooden rims have ousted those of steel. Some riders have long wanted wooden handle-bars, but could not buy them. Now several manufacturers offer them for sale, although the dealers do not seem to have a large supply on hand. The price is $2.50 to $5 apiece. The chief advantage of them is that they absorb vibration. Wheelmen often complain of a numbness of the hands and wrists after long rides, and even after short ones over cobblestones. The wood is springy, and prevents this after effect, as well as adding to the pleasure during the ride. Then, too, there is a saving in weight. A wooden handle-bar was found to weigh 17½ ounces, against 25½ ounces for the steel one which it replaced. This, however, is only a secondary consideration. There is, perhaps, little choice in strength between the two kinds. It is confidently asserted that any accident which would break a bar of elm or hickory would do serious damage to one of hollow steel, such as is in general use. The new handle-bars are covered with cork where they are grasped by the hand.

Correspondence.

The Gold Dollar.

To the Editor of the SCIENTIFIC AMERICAN:

I inclose the following clipping from the SCIENTIFIC AMERICAN of May 19, 1849:

"THE GOLD DOLLAR.

"This beautiful coin has at last been issued. It is somewhat smaller than a five cent piece, and is very beautiful. It is our opinion that it is the most beautiful coin in the world."

Need I ask if you have found reason to change your opinion of the gold dollar, as expressed forty-seven years ago?

I found the clipping yesterday, and think it may interest you at this strange hour of our country's history. M. POWEL.

Newport, Rhode Island.

[We see no reason for changing our opinion in regard to the beauty and worth of the little coin.—ED.]

Nothing New Under the Sun.

To the Editor of the SCIENTIFIC AMERICAN:

Having just been looking over a bound volume of the SCIENTIFIC AMERICAN for 1846 and 1847, volume two, of your magazine, I beg to call your attention to two points therein, which are very interesting in view of, first, the discovery of the pneumatic tire, and second, the X rays of Roentgen. For the first, refer to bottom of first column, page 262, volume 2, issue of May 8, 1847. It shows that the exact principle of the pneumatic tire was in use at that early day.

Second, seventh article of third column, page 290, volume 2, issue of June 5, 1847, states that a Belgian savant has discovered that electric light makes human bodies so diaphanous as to make the arteries, nerves, etc., visible, and their action studiable.

Although Crookes tubes were not mentioned, it is possible that some similar device was used, in the then undeveloped state of electrical science. It would be interesting to know whom the Belgian savant was.

Standard, Florida. A. C. FIRTH.

[We reprint the items to which our correspondent refers.—ED.]

PNEUMATIC TIRES.

A number of cabs with newly invented wheels have just been put on the pave here. Their novelty consists in the entire absence of springs. A hollow tube of India rubber about a foot in diameter, inflated with air, encircles each wheel in the manner of a tire, and with the addition of this simple but novel appendage the vehicle glides noiselessly along, affording the greatest possible amount of cab comfort to the passenger.—SCIENTIFIC AMERICAN, May 8, 1847.

THE X RAY IN 1847.

A Belgian savant says he has just discovered that electric light directed on the human body makes it so diaphanous as to enable the arteries, veins and nerves to be seen at work, and their action to be studied.—SCIENTIFIC AMERICAN, June 5, 1847.

Absorption Photography and X Rays.

To the Editors of the SCIENTIFIC AMERICAN:

The scientific interest connected with the Roentgen or X rays has brought out, through a large number of investigators, a great variety of phenomena bearing directly or remotely upon the original methods and results. While studying the work of others on the X rays proper, the recollection of an accident which the writer had in some photographic work led to a series of experiments along a line which may or may not be connected directly with the Roentgen rays. The experiments were begun about the middle of March and are not yet finished. So far as the writer is aware, no work has been reported in just this line of investigation. The object of the experiments was to ascertain, if possible, if photographic negatives could be gotten similar to X ray negatives by the action of energy previously stored in certain bodies. The results of the experiments which are to be given seem to point very strongly to an affirmative answer.

Experiment No. 1.—From a newspaper was taken a cut of a pair of eyeglasses, and from a glazed paper was taken another cut. These were exposed for about an hour to sunlight and were then removed to a dark room, and after cooling were placed over a common sensitive glass plate and very carefully and thoroughly wrapped in white cloth and paper and then placed in a tight box and allowed to stand in a dark room for about one day. At the end of this time the plate was slowly developed and found to reveal the picture clearly, the one on the unglazed paper being slightly more distinct. A similar experiment was tried, using lamp instead of sunlight, and gave similar but not so strong results.

Experiment No. 2.—At the same time that No. 1 was being carried on, a figure cut from the inside leaf of a book which had been in the dark for the most part for a year or more was, without exposure to light, placed over a sensitive plate. No results were secured in this case.

Experiment No. 3.—Over a pine board was placed a black woolen cloth, and to this were fastened fragments of zinc, copper, graphite, silver, glass, rubber, and wood. This was exposed to sunlight for an hour, and after cooling was placed over the sensitive plate, carefully wrapped in cloth, and placed in a tight wooden box and kept in the dark room for about one day. Upon developing, only the wood and rubber showed much.

Experiment No. 4.—On a small piece of pine board were fastened the following articles: muscovite, copper coin, mica, an iron key, and a piece of glass. The whole was then exposed to sunlight for an hour, taken to the dark room, and when cool all the articles were removed and the wood placed over a sensitive plate and thoroughly protected by wrapping in cloth and placing in a tight box in the dark room. After one day the plate was developed, and all the articles were revealed on the negative by light figures, but the iron key and the copper coin seemed best to shut out the light. Similar experiments were successfully performed by exposure to powerful incandescent gaslight and to incandescent electric light, though the results were not so intense as by sunlight.

Experiment No. 5.—A key was placed over one side of a common Kodak roll film and a piece of brass placed on the opposite side. These were placed in a dark box and connected with the two poles of a battery for several hours. When developed, a very faint shadow appeared.

Experiment No. 6.—A piece of mica and an iron key were heated in an alcohol flame till the edges just began to be red hot. They were then allowed to cool and were placed over a sensitive plate in a perfectly dark box in a dark room for twenty-four hours. When developed, there was revealed the shadow outline of each.

Experiment No. 7.—A current of electricity from a dynamo, sufficient to produce a small spark, was passed through an iron key. The key was allowed to cool and was then placed over a sensitive plate, in a tight box, for twenty-four hours or more. When developed, there was seen the shadow outline of the key.

Experiment No. 8.—A fresh fern stem was placed over a sensitive plate, and after being so kept for twenty-four hours, the plate was developed and there was revealed the outline of the whole stem, with a much darker central portion corresponding to the circulatory system, all of which was very clearly brought out.

In some of the experiments which have been mentioned there was contact with the plate, while in others equally good results were obtained without contact. Considerable skill and a rather long time were required in the developing process. The results described are but a few of those obtained along this general line of study. It will appear from these experiments that in no case did the light pass through the object to be photographed; and further, that light is not necessary.

All of these experiments, but especially those in which the objects were heated or exposed to an electric current, and subsequently cooled in the dark, indicate, first, that the photographic action is due simply to energy stored in the body to be photographed and afterward slowly given off, there being a great difference in the power of absorption and radiation in various substances; second, that this energy may be from other sources than luminous rays, if these only reach a maximum rapidity of vibration; and that when this rate of vibration is reached a molecular change in the silver salts of the photographic plate is started, with greater or less intensity, depending upon the character and source of the energy, and completed in the developing process.

From certain researches now being made, the writer would venture the suggestion that possibly certain phenomena connected with the Roentgen photography proper may be in part explained by these general statements. He hopes to present, at some future time, a series of experiments of such a nature as to confirm this statement. E. J. BABCOCK.

Chemical Laboratory, State University of North Dakota, July 21, 1896.

[We have examined the photographs made in the manner described. They clearly show that the objects represented must have stored considerable energy to have produced the results secured by Professor Babcock.—EDS.]

The Holtzer Projectile.

To the Editor of the SCIENTIFIC AMERICAN:

In the SCIENTIFIC AMERICAN of July 4 you give an interesting résumé of tests of the Harvey-Carnegie plates destined for Russia, in which you say:

"The plate was attacked in rapid succession by five 6 inch and three 4 inch Holtzer armor piercing shell fired at high velocities."

And farther on you add: "While its ability to keep out and completely pulverize a 6 inch Holtzer shell when fired at a striking velocity of 2,149 foot seconds, showed what splendid ballistic resistance it possessed."

We are thoroughly convinced of the excellence of the Harvey-Carnegie plates, but we must make some reservations in regard to the production of the shells used. In the first place, we have never made 4 inch projectiles for the United States. Further, if we delivered any 6 inch projectiles, they were made more than four years ago, and at that time the superiority of the Harvey plates had not been established.

If these plates have been improved since then, we have introduced also improvements of our manufacture and we can now make projectiles capable of piercing (without being broken) Harvey plates, provided that the increased velocity is given to these projectiles required by the greater resistance of the new plates.

We would be greatly obliged if you would make your readers acquainted with the real condition of affairs by inserting a correction in an early number of your paper. JACOB HOLTZER & COMPANY.

Acieries d'Unieux Loire, France.

[We published the statements in regard to tests as furnished to us by the authorities in March.—ED.]

The Healthfulness of Sewage Farm Products.

Concerning the question of the healthfulness of crops grown on sewage disposal farms, the Hospital speaks as follows:

"This is a question which cannot be settled with a precision approaching to the mathematical, either in physiological laboratories or by means of statistics gathered from the experience of the community at large. But there is an old scientific method, now a good deal despised, whereby men of intelligence can arrive at trustworthy conclusions; and that is the method of careful observation, personal experiment, and an appeal to the court of common sense. By the use of this method many facts like the following have been accumulated by generations of experimentalists, and they settle the controversy in a practical sense. For example, if a cow is fed on turnips, within twenty-four hours her milk will taste of turnips, and if butter be churned from the cream, the butter will taste too. The intensity of the turnip flavor is the measure of the quantity of turnips taken. In like manner, if pigs be fed on horseflesh, as they often are, their bacon will taste of the horseflesh; if they be fed on fish, the bacon has a fishy taste. The same is true of hens and their eggs. Feed hens on decaying animal matter, which they will eat greedily, and both their eggs and flesh will be most unpleasant and unwholesome eating. In the case of ducks the facts are much more striking. Ducks are very unclean feeders. Give them abundance of garbage, and they will refuse corn and similar food. Their flesh is then most pungent to the taste, and in many people is so potently poisoning as to produce diarrhœa. Animals fed on sewage farms under certain conditions are liable to have their flesh and secretions changed in character by the sewage-produced herbs and grasses upon which they feed. If the sewage on a given farm be so managed that no more of it be put into the soil than any given crop can adequately deal with, then the crop will be sweet and natural, and the cattle or other animals fed on it will be sweet and natural too. But if the soil be gorged to repletion with sewage, then the crops will be surcharged with sewage elements, and unfit for food, and the meat and milk of animals fed on such crops will be like the crops, and very unpleasant to the taste as well as dangerous to health. It is in the last resort all a question of the intelligence and conscience of the managers of sewage farms."

Ground Moles in Sugar Beet Cultivation.

When farmers take upon themselves the destruction of ground moles, they little realize that they are working against their own interest. The animals live entirely upon insects and can devour in twenty-four hours several times their own weight, leaving all vegetable matter alone. If the surface of the soil shows indication of their presence, it may be declared in advance that they have found on their passage through the substrata the requisite food for their maintenance, which in the case of beet cultivation generally means white worms. These would have subsequently come to the surface and partially destroyed a crop of beets. That rows of roots have suffered from ground moles is insignificant in comparison with acres of beets that would have been victims of insect ravages. It frequently happens that the tiller prides himself upon the success of his beet crop, while his neighbor, suggests the Sugar Beet (journal), has been less fortunate when the real cause may have been that in the latter case the ground moles have been destroyed and in the former they were left to themselves.

The Largest Ship in the World.

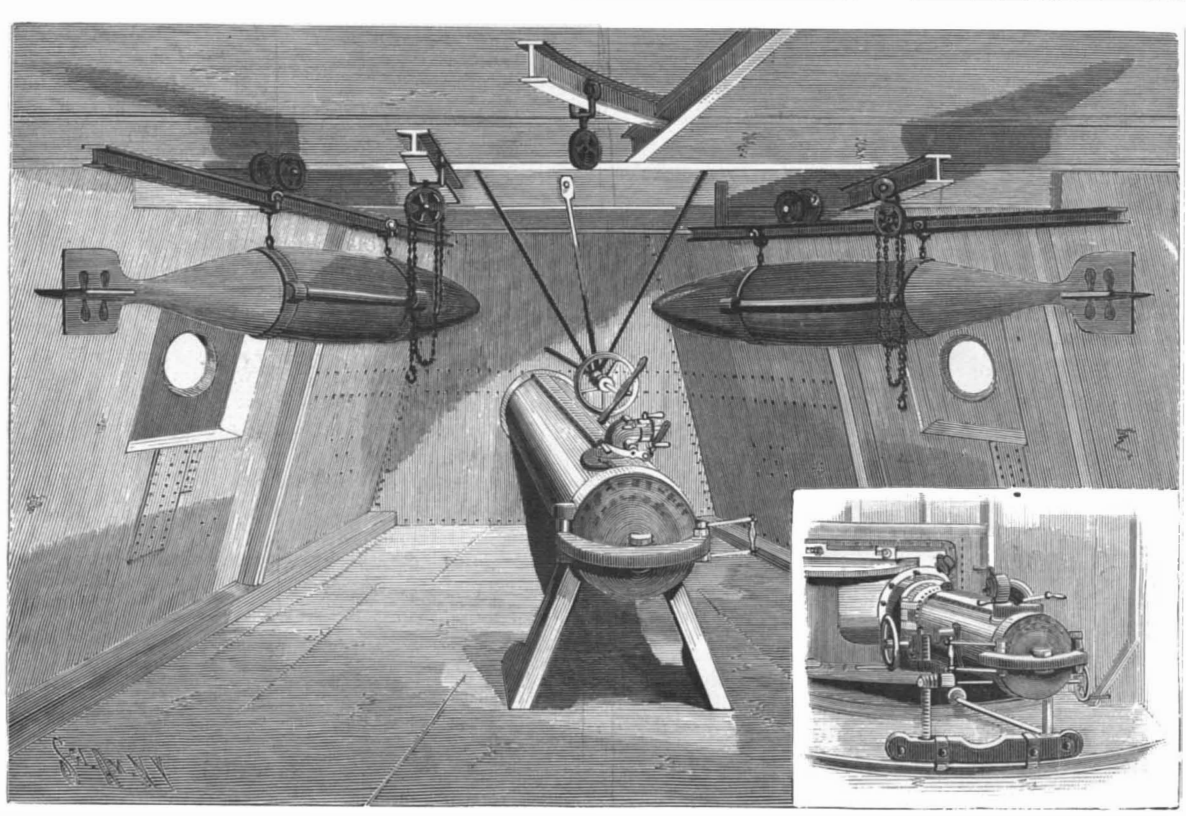
According to Prometheus the largest ship in the world is building at the Vulcan shipyard in Bredon, near Stettin, Germany, for the Hamburg-American line. The same builders constructed the first large express steamer built in Germany, the Augusta-Victoria, of the same line. The new monster steamer has a length of 625 feet on the waterline, and is therefore considerably larger than the Campania, which is 600 feet in length between perpendiculars. The engines will have 27,000 horse power and a speed of 22 knots is expected. The engines and boilers will also be furnished by the Vulcan shipyards. Construction has been commenced already.

THE UNITED STATES FIRST CLASS BATTLESHIP INDIANA.

A visitor on approaching the battleship Indiana by water, as she lies at anchor in a roadstead, is first of all impressed with the power of destruction which is suggested by the gleam of the many pairs of long and powerful guns with which she fairly bristles. They are her distinguishing feature, and mark the Indiana as the most powerful fighting machine in the world today. Not only is she able to give the hardest blows, but she could stand more hammering than any other ship. There are faster battleships, and bigger, but none that could hit so hard or endure so long.

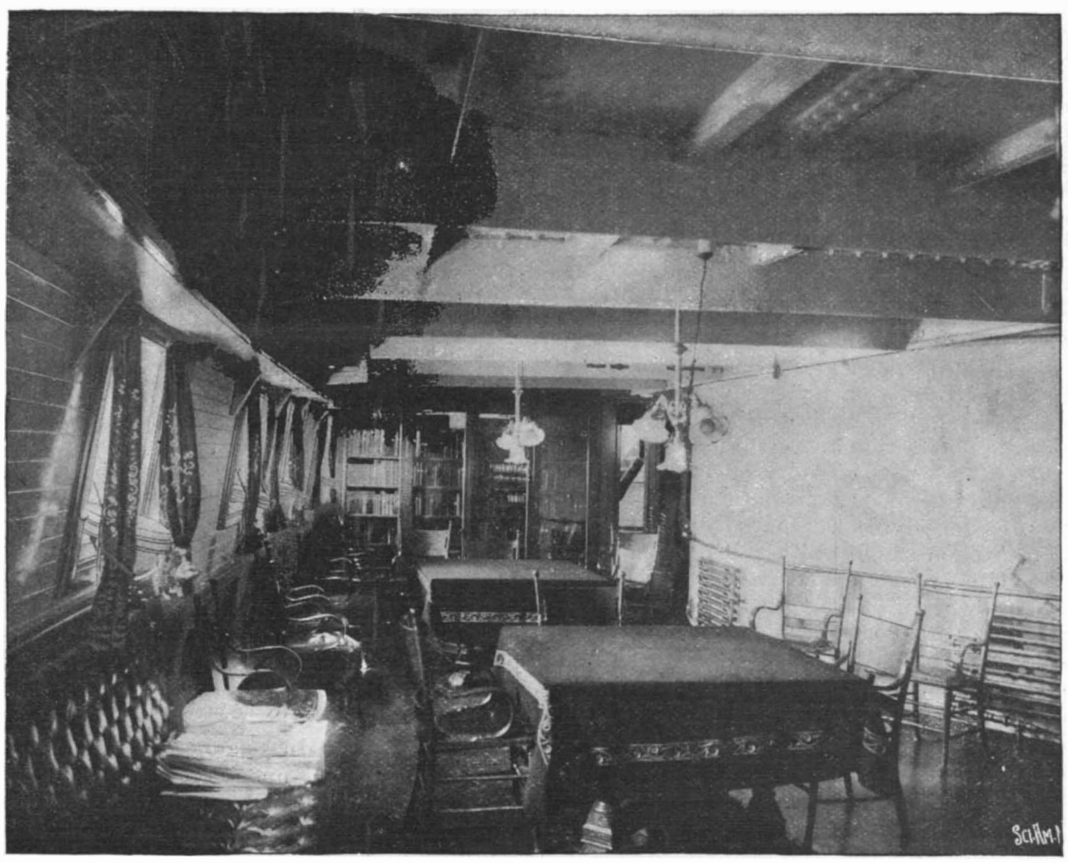
Together with the Massachusetts and the Oregon, she was built for the defense of the maritime cities and harbors. The trio might aptly be termed the watch dogs of the coast.

Looking at her massive form, it is difficult to realize that she has greater bulk below than above water. The floor of the outer shell of the hull lies 24 feet below the water line, and is some 348 feet long, and 69¼ feet broad at its widest part. Within the outer shell, and 3½ feet distant from it, is an inner shell, each being watertight, and forming a complete ship's hull in itself. The space between the two is divided up laterally by the plate frames (answering to the wooden ribs of the old three-deckers), which are riveted to both shells. These lateral spaces are again subdivided by a series of plate frames, or girders, which run the length of the ship, being riveted to the cross girders at the intersection, and also to the inner and outer "skin" of the ship. This arrangement cuts the space into small compartments, or "cells," each separate and watertight. The double bottom constitutes the below water armor or protection of the ship against the torpedo, for while the explosion of these deadly weapons might break in the outer skin, the inner skin would possibly remain intact, and the flooding would be confined to the cells in the neighborhood of the explosion. If the inner skin should be broken, the inflow of water would be localized by the athwartship and longitudinal watertight bulkhead, which extend above the water line.



BOW TORPEDO ROOM.

BROADSIDE TORPEDO.



WARDROOM MESS.

The double skin rises to within 4½ feet of the water line, where it forms a shelf, upon which is carried a wall of Harvey steel armor 8½ feet high, 18 inches in thickness, and extending amidships for two-thirds of the length of the ship. At each end of the side walls is a transverse wall of steel, slightly thinner, but of the same height. The roof of this great rectangular fort is formed of 2¾ inches of steel, and down below its safe shelter are placed "the vitals," that is, the engines, boilers, and stores of shot and shell. Forward and aft beyond the 18 inch side belt, the steel deck is extended in a gradual curve to meet the bow and stern. This steel deck is known as the berth deck, and some eight feet above it is the main deck, which extends flush throughout the ship, and finishes the hull proper. The line of this deck may easily be traced in the first of the illustrations on the front page. Between the top edge of the 18 inch belt and the main deck the protection consists of 5 inches of steel, backed by some 10 feet of coal, which will together keep out all the rapid fire shells, and such of the heavier shells as are fired from long ranges, or strike obliquely to the armor—as many of them will.

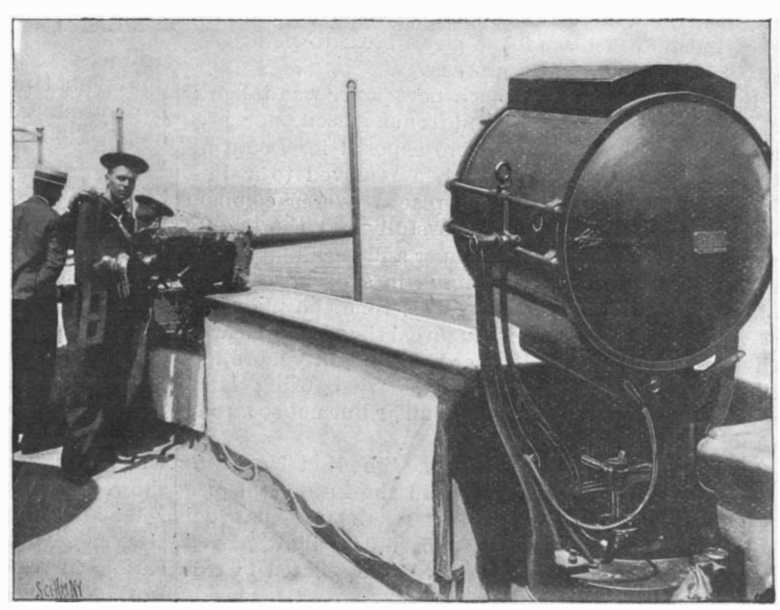
If we walk along the main deck to the starboard bow and look back, we get the view shown in the second illustration on the front page. The most striking objects are the muzzles of the two forward 13 inch guns, which show their black mouths protruding 23 feet through the portholes of the revolving turrets. The turret is formed of a solid circular wall of steel 17 inches thick, which revolves upon a circular track, located just below and within the top edge of a circular steel fort or barbette 17 inches thick, which is built up from the 18 inch armor belt below. It will thus be seen that from the top of the turret down to 4½ feet below the water line there is a continuous wall of steel 17 and 18 inches thick for the protection of the gun crew, the turning machinery, and the powder and shell. In the uncertainties of war it is not likely that one shot in thirty that struck this turret would effect an entrance; and experience shows that not one-fourth of that number would probably score a hit in half a day's fighting, if the battle of the Yalu is anything of a guide. Just over the muzzle of the starboard gun is seen the turret sighting hood with its two horizontal and two vertical slots, or peep-holes, from which the gunner watches the enemy, and, by means of convenient levers, trains and fires the guns.

Peering over the main turret are seen the four forward eight-inch rifles, placed in pairs in two turrets, one on each side of the ship. The turrets are of eight-inch steel and revolve within barbettes of 10-inch steel, the offset in the outer wall, seen clearly in the illustration, showing the top edge of the barbette. Armored ammunition tubes pass from the barbettes down to the 2¾-inch steel deck before mentioned, for the passage of the powder and shell. Upon the main deck, and under and slightly to the rear of each eight-inch turret is a six-inch gun, which is capable of broadside and dead ahead fire.

If we take our stand at the stern and look forward we see the same arrangement of turrets and guns; so that, with the exception of the pilot house, conning-tower, and mast, the after half of the ship above the main deck is a duplicate of the forward half.

To the rear of the forward 13-inch turret, and forming the base of the military mast, is the conning-tower, which is plated with 12 inches of steel. Here the commander will take up his position when going into battle, and through the narrow horizontal slots (to be seen just above the sighting-hood of the forward turret) he will watch the enemy. Inside the tower is an elaborate arrangement of telephone electric apparatus, and speaking tubes, by which he can communicate with the engine rooms, the various gun stations, and the steering room, at the after end of the ship. This latter is situated for protection below the water line. When the ship goes into action, one man, snugly ensconced within this little steel cage, can lay his hand upon any part of the ship, controlling her speed, turning her right or left at will, and concentrating her guns at will upon any weak spot in the enemy. Above the conning-tower is the pilot house, from which the navigation of the ship is carried on except in the actual time of battle.

Upon the roof of the pilot house, one on each side of the mast, are two 100,000 c. p. search lights, and on the small platform, just above them, are the two controllers, by means of which the beam of light may be raised or lowered and made to sweep the full circle of the ship. On the same platform is a range-finder, by which the distance of the enemy can be very accurately determined. A similar pair of search lights and a range-finder are located on the over deck, above the after end of the bridge deck. Our illustration shows the after port search light and one of the 6 pounder guns. If

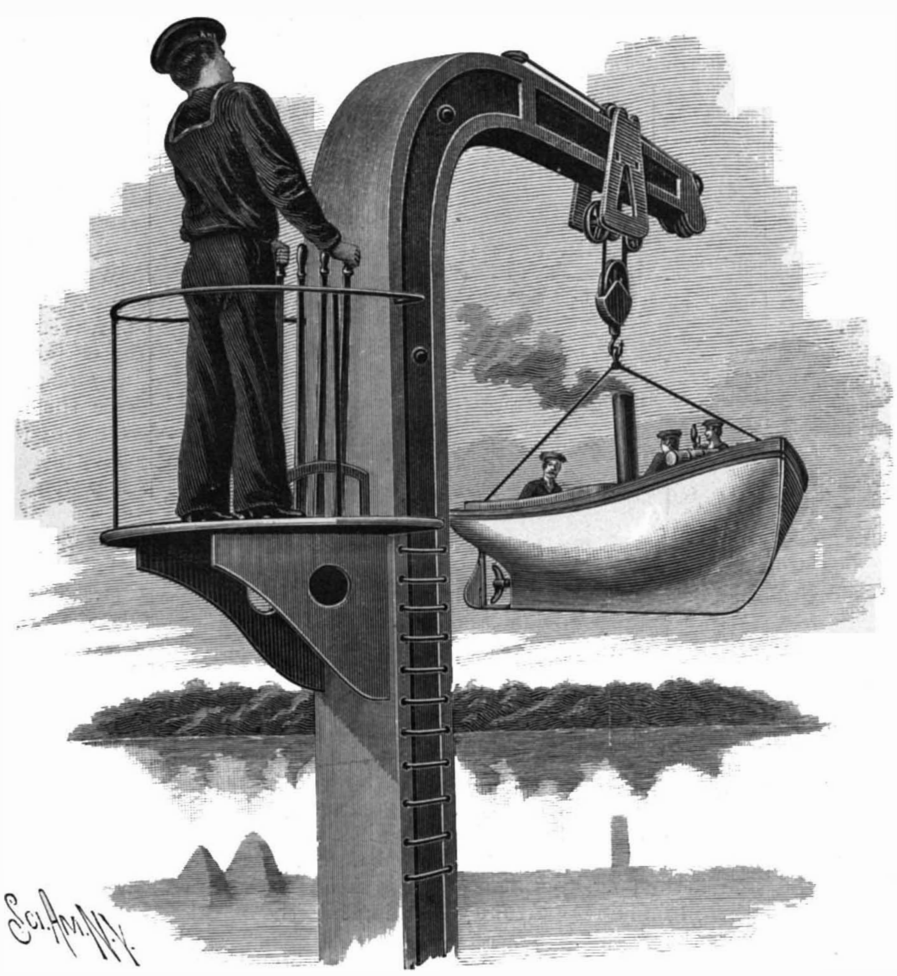


A 100,000 CANDLE POWER SEARCH LIGHT.

the visitor descends to the berth deck and walks to the extreme forward end of the ship, he will find himself in the bow torpedo room. Immediately in front of him he will see the fixed launching tube, which is built into the framework of the ship, parallel to its axis, and is inclined slightly downward to the water. Its outer end is closed with a cover plate shown on the front page view above the water line at the bow. Suspended from the ceiling are the 18 inch Whitehead torpedoes. When they are to be fired they are picked up by the chain hoists, run along the overhead tracks and lowered into the tube. The breech is then closed, and the torpedo is discharged, either by compressed air or by a small powder charge.

The torpedo, which weighs 835 pounds, contains three compartments. In the first is the charge of guncotton, which is fired by contact; the second is charged with air at 1,300 pounds to the square inch pressure; and the third contains the little compressed air engines, which work the screw propellers. It is provided with horizontal rudders, by which it can be made to run at any desired depth. The shock of discharging the torpedo starts the engines, and they will drive it for 400 yards at 30 knots, or for 800 yards at 27 knots, an hour. There is another fixed torpedo tube at the stern, and on each broadside there are two movable tubes—as shown in the smaller cut—which are fitted to the side of the ship with a ball and socket joint, and are capable of being trained on an object in the same way as the guns. The space between the main turrets is occupied by the superstructure deck and the bridge deck, upon the latter of which are stowed the lifeboats, gigs and steam pinnaces. On each side of the ship a powerful steam crane is provided, with sufficient reach to enable it to pick up a boat from the water, lift it 35 feet into the air, swing it round, and lower it into position on the bridge deck. It is operated by a man who stands on a platform attached to the crane, where, by means of levers, he can control the various motions of lifting and turning. Last thing to be provided in planning the Indiana was the living quarters of the officers and crew. In general, the officers' quarters are found aft of the after turret and on the berth deck. Our illustration shows the officers' wardroom mess, which the landsman would term a dining saloon. At the far end of this room will be seen a select library of scientific works. The extreme after end of the ship is occupied by the captain of the ship. The living quarters of the crew are forward upon the berth deck and upon the main deck within the superstructure.

Our illustrations were made from photographs obtained through the courtesy of Capt. Robert Evans, and Lieut. Frederick L. Chapin.



THE STEAM LAUNCH HOISTING CRANE.

Sea Mosses.

BY EUGENIA PRUDEN.

One of the pleasantest seashore occupations is the collecting and mounting of sea weeds, the "ocean's flowers." The process is very simple and easily accomplished, if one goes at it rightly and can have the patience to be particular to the extreme of preciseness.

The paraphernalia or outfit necessary for the collector is, first of all, suitable clothing for himself, as, in this work, one must not be afraid of wettings. The finest specimens are always sure to be outside one's reach from dry land. It seems as if the waves had a special spite against such seekers, and they are always on the lookout for every possible chance to give a ducking.

A small meshed net attached to a long light pole, and a pail of some kind, are all the implements that are really necessary for collecting. The scientist would add some bottles containing alcohol for preserving specimens for microscopic study; also he would carry in his pail some large-mouthed bottles for keeping the different species separate. The amateur who knows not one kind from another should pick up all he comes to and decide upon the keeping after floating each one by itself.

The best time for collecting is at half flood. When the tide is flowing, mosses are more plentiful. The favorite place for collecting is below the low water mark. Rocky shores, small pools, especially if they are rocky, old wharves and piers are usually good collecting grounds. Now and then one can find some very good specimens on the beach; still, this is uncertain, it being only occasionally that they are washed ashore.

As far as possible, use nothing but sea water with mosses. Should it be impossible to obtain this in sufficient quantity, then make the water salt by artificial means. When collecting, put the mosses in the water, keeping them there until mounted. Experience has shown that the delicate varieties cannot be dried successfully, to soak out and mount at leisure. The larger, coarser ones, like rock weeds and devil's apron, it does no harm to dry and soak out at will; at best these can only be pressed and mounted like flowers. Another very necessary point to be observed is that the floating and mounting should be done as soon as possible after collecting. Leaving them in soak over one night only has frequently been sufficient to extract all their brilliancy of coloring, and in some cases has rotted them down completely.

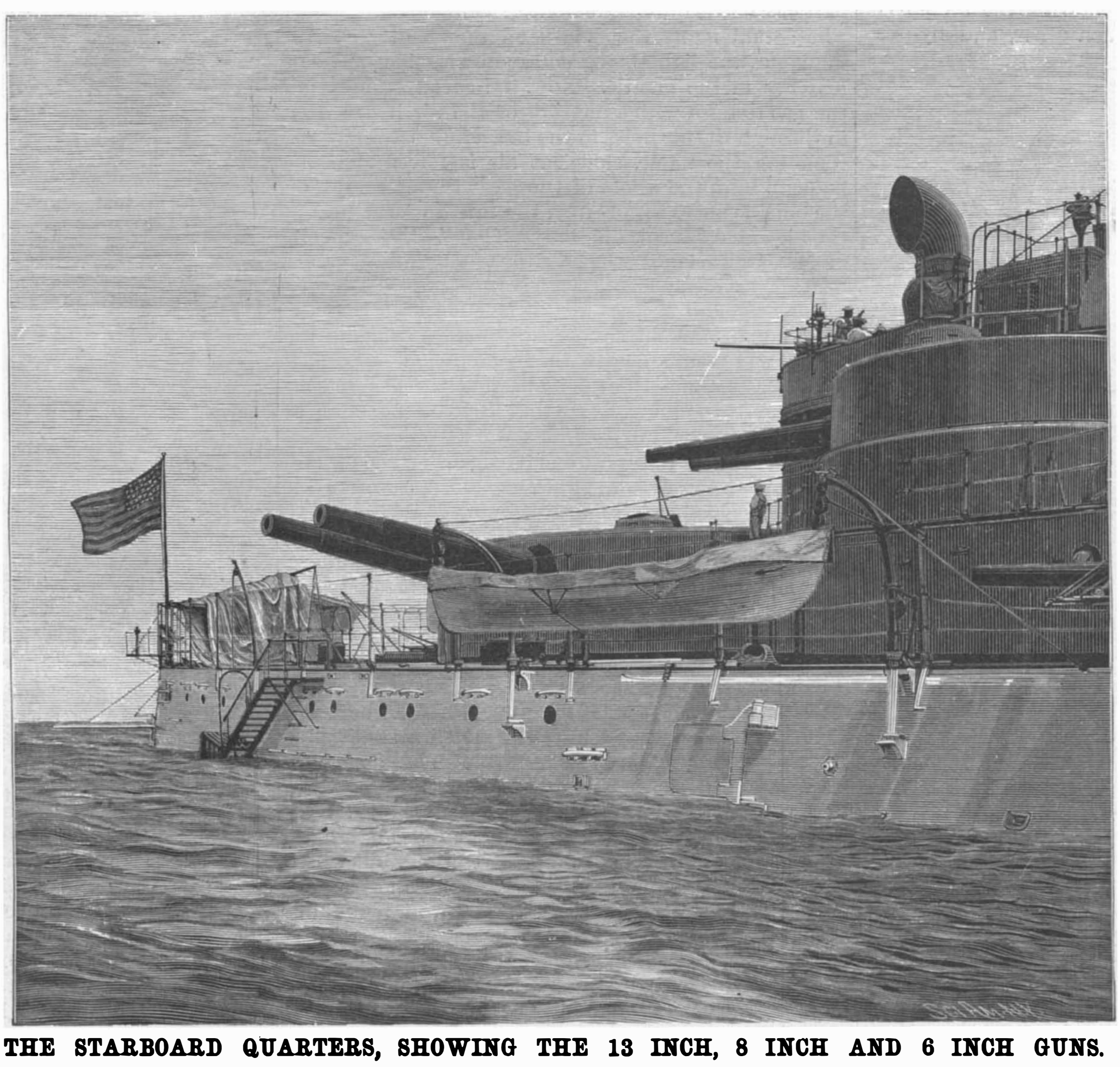
A moderately thick, unglazed paper is best for mounting, although any kind may be used if not too thin. Many procure cards from the photographer which are very good.

In mounting, have at hand two dishes with plenty of water; one of ordinary size, in which the plants may be floated and washed, while the other should be large enough to take in easily the card to be used. When the moss is transferred to dish number two, place the card underneath, letting it rest on the palm of the left hand. Take an ordinary hat pin in the right hand and gently work the moss into its natural position of growth, just as one would arrange a plant for pressing. At the same time that this working out and arranging process is going on, the left hand should be busy manipulating the card by various tips and turns, so that when it is finally drawn from the water the moss adheres in lifelike form. All the details are difficult to give in words. Experience and practice are the best teachers.

After the moss is in place and the card is taken out, incline it slightly that the water may run off entirely before being put in press. The driers used in pressing should be of some absorbent paper, like the pads used by the botanist, or the ordinary blotting paper. The cards are laid on this paper, with moss uppermost, then covered with any thin white cloth from which all dressing has been previously removed, then another layer of paper, and so on to the end. On the top of all place a board weighted down with stones, the amount of pressure being governed by the quality of moss, the coarser varieties requiring more than the finer, more delicate ones.

The majority of specimens will adhere to the paper naturally; still there are some that will require an extra fastening of mucilage. The driers should be changed twice a day until the cards are dry, which in some cases will be accomplished in one day, while again in others it will require several.

A poorly mounted specimen is worse than nothing, while, on the other hand, one well done makes a picture such as no painter's brush could ever hope to excel in delicacy of tone and coloring. — The Outlook.


THE STARBOARD QUARTERS, SHOWING THE 13 INCH, 8 INCH AND 6 INCH GUNS.

Steel Rails for New South Wales.

The government of New South Wales, as will be seen by an advertisement in another column, is desirous of making a contract for the manufacture, in that colony, of 150,000 tons of steel rails, with fish plates, bolts, etc. Any one wishing to undertake the business must state the prices per ton for the manufacture and delivery, each tender to be accompanied by a deposit of $25,000, and the delivery of the rails to be at the rate of fifteen thousand tons per annum, but the manufacture must be entirely in the colony, out of iron mined there, and with native coal, coke, or other fuel. The delivery of the rails is to commence eighteen months after signing contract, and be spread over a period of ten years.

A Smokeproof Fireman's Cap.

That a woman has been successful in inventing a cap for use by firemen in going through rooms filled with smoke, should be encouraging news to women inventors generally. According to the Syracuse Standard, it appears that Mrs. John H. Miller has invented such a cap, described as follows:

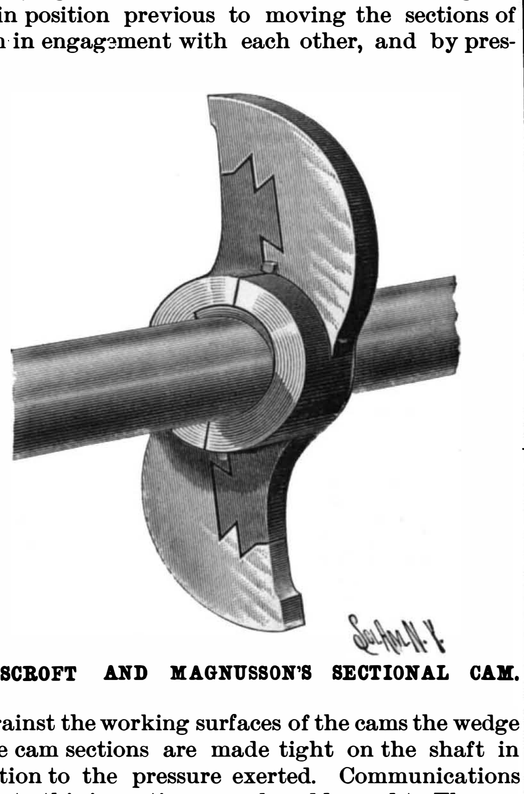
The cap is made of fine strips of asbestos conformed to the shape of the head. It is held fast in place by a rubber band, making it airtight. Its weight is only sixteen ounces, and it is so constructed as to enable a person to carry it on the arm without inconvenience. There is a strip of mica before the eyes; so no inconvenience is suffered in this respect. A silk sponge, through which no smoke can enter, but which permits the ingress of air in plentiful quantities, fills an aperture for the mouth, and when properly adjusted the cap is so simple that its efficacy is apparent at a glance.

When it is understood that firemen are unable to remain in a smoking building longer than three or four minutes at a time, an invention of this character, which enables a man to grope about in a stifling atmosphere for an hour, certainly reduces chances of losing life through suffocation to a minimum.

A practical trial of the cap was given in Syracuse which worked perfectly. Mr. Miller, the husband of the inventor, put on the cap and entered a smokehouse so densely filled with smoke that it was impossible to go near the door without protection, and there remained 35 minutes, with no possible chance of getting air from the outside. A fireman connected with No. 1's company entered the smokehouse without the contrivance, and remained eight seconds before coming into the fresh air, half suffocated and gasping for breath.

A SECTIONAL CAM.

A cam especially adapted for use in stamping mills, and which may be readily removed for repairs or replaced by a new one without disturbing the cam shaft and the other cams, is shown in the accompanying illustration, and has been patented by George W. Ravenscroft and Nils L. Magnusson, Mogollon, New Mexico. It has a two part hub, fitted on the cam shaft and fastened against lateral movement by two keys driven radially into the hub parts at their joint, and the hub parts have cam wings extending in opposite directions, with the usual curved cam surfaces to engage and disengage the arms of the stamp rods. In the rear edges of the wings are dovetailed grooves engaged by dovetailed arms extending from the hub parts. The two parts of the cam are readily moved into engagement with one another by moving them toward each other from opposite sides of the cam shaft, and the keys are then inserted at the joint of the hub parts, to hold them in place and prevent lateral displacement of one hub part relatively to the other. To insure a positive tightening of the cam on the shaft, a curved wedge is fitted on the shaft and in recesses formed in the hub parts at one of the joints, the base of the wedge having an inwardly extending lug engaging a recess in the shaft. The wedge is placed in position previous to moving the sections of the cam in engagement with each other, and by pressure against the working surfaces of the cams the wedge and the cam sections are made tight on the shaft in proportion to the pressure exerted. Communications relative to this invention may be addressed to Thomas F. Cooney, of Cooney, New Mexico.



RAVENSCROFT AND MAGNUSSON'S SECTIONAL CAM.

Death of Sir Robert Grove.

The Right Hon. Sir William Robert Grove, D.C.L., LL.D., F.R.S., died in London on August 2. He was born in Wales in 1811. He was educated at Oxford and became a lawyer. Being temporarily prevented by ill health from following his profession he turned his attention to electricity, and in 1839 invented the powerful voltaic battery which bears his name, and the gas battery.

A NEW LIGHT FOR PHOTOGRAPHERS.

BY C. F. TOWNSEND, F.C.S.

Four hundred candle power for 10 cubic feet of gas burnt per hour, costing one farthing! Noiseless, powerful yet soft, absolutely steady! What more can a photographer or anybody else desire in the way of gas lighting? My attention was called to the new lamp by a brilliant illumination appearing through the doorway of the workshop at King's College, where, like a good photographer, I was devoting my spare time to the mysteries of cabinet making. The light seemed too bright for incandescent gas light, and yet not cold and ghost-like enough for the electric arc; so my picture frames were neglected, and I proceeded to the engineering shops whence the light was coming. Here I saw a number of what appeared to be large incandescent gas mantles, mounted on cylindrical copper tubes screwed into the ordinary gas pendants. The brilliancy of the light, however, showed that something unusual was at work, for the large machine shop was as bright as day. In a few minutes I was introduced to M. Caton, the inventor, who was superintending the experimental installation. With the greatest courtesy and much enthusiasm, M. Caton explained the principles on which his invention, "La Lampe Caton," was based, and invited me to call on him in Leadenhall Street, where I had an opportunity of going into the question more thoroughly.

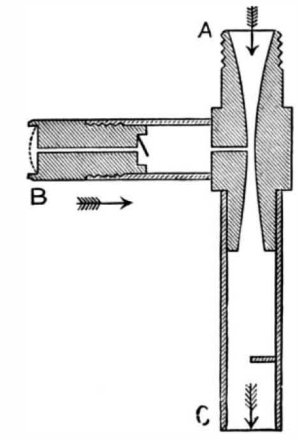


Fig. 1.—THE ASPIRATOR.

Before describing the new lamp further, a few words about the principle on which the incandescent gas light works will make the account of the light more intelligible. A Bunsen or other similar burner, in which a mixture of air and gas is burned, is non-luminous. To produce luminosity it is necessary to have solid particles of some kind in the flame. A candle is luminous, because one zone of the flame contains solid particles of carbon, which are raised to a white or yellow incandescence by the intense heat. The hotter the flame, the greater will be the quantity of light given off by the incandescent body. In the ordinary incandescent burner, the mantle, composed of a fine network of infusible substances similar to lime, takes the place of the carbon particles of the ordinary candle or luminous gas flame. The actual flame that plays on the mantle is non-luminous, the light being emitted by the incandescent material in the mantle. Now, if instead of allowing the gas to burn with a mixture of the air it can drag in through the air holes in the burner, and the air surrounding the flame, sufficient air is forced into the flame to burn the whole of the gas without calling on the outside air to supply any, the intense local heat of the blowpipe flame is obtained. That is the principle of M. Caton's lamp: the mantle is kept at an intense heat by a blowpipe flame.

The secret of success in the new burner is that the gas and air are mixed perfectly before reaching the flame, and consequently the combustion is perfect. Another most important point is that the gas and air travel at the same rate, so that there is no noise or flickering.

This desirable end is attained by causing the air and gas to pass through a spiral tube, or series of tubes, whence they issue thoroughly mixed. It is essential to success that the tubes should be cut to a particular pitch or angle, which the inventor has determined. To a lanternist this mixture of gas and air before reaching the burner will seem dangerous in case of lighting back, but the mixing tubes are safeguarded by wire gauze. Even without this the inventor declares that the quantity of air and gas actually mixed at one time is too small to cause an explosion. In cases where the burner has been damaged accidentally, a slight puff has followed and the gas has been blown out; nothing more.

The air necessary for combustion is supplied by a small injector, worked by water pressure. For a large installation a metal one would be required, but where only a few lamps were used a glass one, such as is commonly used in chemical laboratories, would be sufficient. The cost of the metal injector would be £1 perhaps, and that of the glass one a few shillings. To this must be added the cost of a few feet of iron or compo piping, as the case may be—a comparatively small item. The cost of the water power required is insignificant. For five 400 candle lamps, eight gallons of water per hour at the ordinary high pressure of town services would be ample. Water is charged by meter at 6d. per 1,000 gallons, so that the water for a light of 2,000 candles would only cost 1d. for twenty-four hours.

The temperature of the flame is 1,800° Centigrade (3,270° F.), so that no chimney can be used with the lamp. Paradoxical as it may appear, the heat produced is less than that given off by burning the same quantity of gas in any other way. Although the local heat is intense, the total quantity given out is comparatively small, because so much of the energy of the flame is converted into light. M. Caton wishes it to be clearly understood that he only claims the lamp, and is willing to use any mantle on the market. Purchasers, therefore, need have no fear of infringing existing patents. The price of the lamps has not been fixed at present, but it will probably not exceed 2s., to which must be added the cost of the mantle. Lamps of all sizes are made, to give light from 25 to 400 candles; the small lamps having the same efficiency as the large ones.

What struck me as the great advantage of the lamp from a photographic point of view was its remarkable diffusiveness. There were no heavy shadows anywhere. Even right under the lamp no appreciable shadow of the pipe could be seen. The light seemed to proceed from the lamp horizontally, to be diffused softly and evenly by the walls. The inventor took me behind a heavy piece of machinery, where with almost any other lamp would have been deep shadow, and it was like being in diffused daylight. Reading was perfectly easy, and colors could be distinguished quite as well as in daylight.—The Photogram.

NOTE.—The two accompanying illustrations show the principle of the water pressure injector. Fig. 1 is a sectional view. The water falling vertically through the small opening draws the air inward through the side duct and carries it into the bottle. Fig. 2 shows the whole apparatus, the pressure of the column of water passing out at the bottom of the bottle, and the flexible tube is the pressure exerted on the air in the bottle above the water, which is used to give a gentle air blast with the gas to the burner.—EDS.

A Lighthouse with no Lantern.

The most extraordinary of all lighthouses is to be found in the Hebrides, Scotland, on Armish Rock, Stornoway Bay—a rock which is separated from the Island of Lewis by a channel over 500 feet wide. On this rock a conical beacon is erected, and on its summit a lantern is fixed, from which, night after night, shines a light which is seen by the fishermen far and wide. Yet there is no burning lamp in the lantern and no attendant ever goes to it, for the simple reason that there is no lamp to attend to, no wick to trim, and no oil well to replenish.

The way in which this peculiar lighthouse is illuminated is this, says the Marine Record: "On the island of Lewis, 500 feet or so away, is a lighthouse, and from a window in the tower, a stream of light is projected on a mirror in the lantern on the summit of Armish Rock. These rays are reflected to an arrangement of prisms, and by their action are converged to a focus outside the lantern, from where they diverge in the necessary direction." The consequence is that, to all intents and purposes, a lighthouse exists which has neither lamp nor lighthouse keeper, and yet which give as serviceable a light—taking into account the requirements of this locality—as if an elaborate and costly lighthouse, with lamps, service room, bed room, living room, store room, oil room, water tanks, and all other accessories were erected on the summit of the rock.

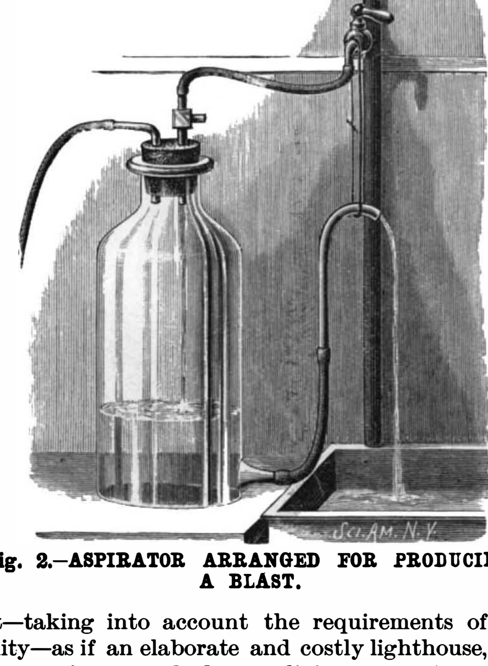


Fig. 2.—ASPIRATOR ARRANGED FOR PRODUCING A BLAST.

Dr. John Haldane, lecturer on Physiology at Oxford University, is one whose labors would appear to deserve more than passing recognition. In his experiments to discover a means of preventing the loss of life among miners, resulting from underground explosions, he actually inhaled carbon monoxide for seventy-one minutes, with the result that vital energy was nearly extinguished, and life would have flown had not oxygen been speedily administered.

THE TOMB OF KING RENE AND QUEEN ISABELLA OF LORRAINE.

Following the example of the majority of princes who were his contemporaries, René I, Duke of Anjou, Lorraine and Bar, Count of Provence and Piedmont, King of Sicily and Jerusalem, etc., the "Good King René," as popular tradition called him, made, in his lifetime, careful provision for his burial. It was in the city of Angers, in the choir of Saint Maurice Cathedral, that he desired to sleep his last sleep, alongside of his wife, Isabella of Lorraine. His "Comptes et Memoriaux," published by Mr. Lecoy de la Marche, prove to us that in 1447 he was already occupying himself with the execution of a monument that he desired should be a sumptuous one, and up to his death this was his constant thought. Three artists were successively employed upon it—Jean and Pons Poucet and Jacques Morel, the designer of the tomb of Charles I of Bourbon and of Agnes of Bourgogne in the Church of Souvigny. All died before putting the finishing touches upon it, and when the king himself departed this life at Aix, July 10, 1480, all was not yet finished.

Of the monument there now remains nothing or next to nothing, but the details of the Comptes and a drawing by Gaigneires, preserved at Oxford, have kept a remembrance of it for us. It consisted, under a richly carved, painted, and gilded arcade, of a sarcophagus upon which reposed the white marble effigies of the king and queen accompanied with three large figures of knights and as many figures of women in the act of mourning.

At the back of the sepulchral vault, a painting upon wood, for a long time attributed, without proof, to René himself, showed the dead king—a crowned skeleton allowing the royal emblems to fall from his hands. Up to the middle of the last century, the monument stood in the first triforium of the choir, on the north side. In 1769, the canons, desirous of wainscoting the choir, moved the monument to the nave. This first mutilation was followed in 1793 by a complete and final destruction.

It was owing to the transfer of the monument from the choir to the nave that the royal remains were not violated at the revolutionary epoch. They had been forgotten.

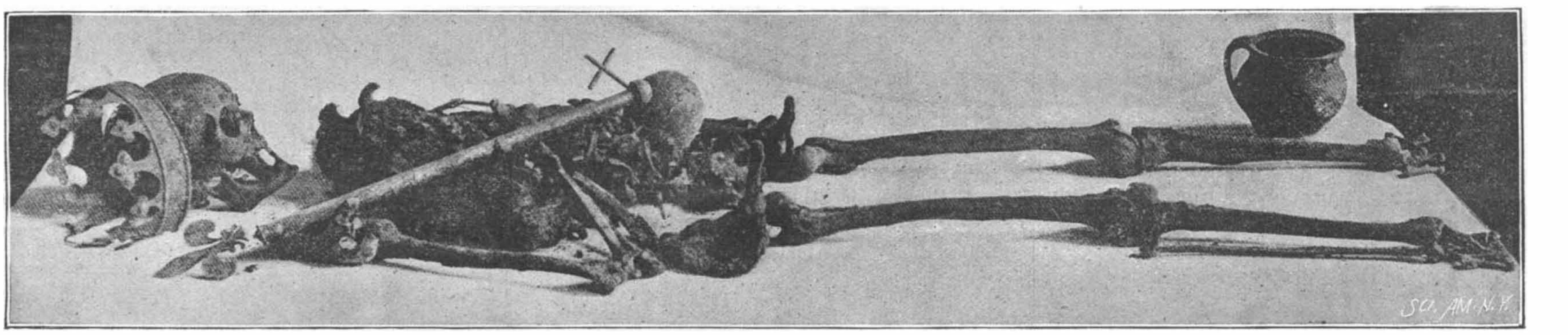
As will be remembered, during the course of some work on the pavement of the choir, September 16, 1895, a fortunate accident led to the discovery of the royal burial vault, and permitted of ascertaining the presence therein of two leaden coffins, one of which was provided near the head with an aperture through which a crown was perceived. There was no doubt of it; it was indeed here that rested King René, and the aperture was really the one that, according to history, was made in 1482 by the incredulous canons in order to verify the identity of the body brought to them from Aix by Queen Jeanne de Laval, second wife of the king. The authentication having been made, the vault was sealed up again.

On the 16th of last June it was again opened in the presence of Mgr. Mathieu, bishop of Angers. The top having been removed, the two coffins were hoisted to the surface—that of the king first. During the course of this operation, the decomposed lower part gave way and the royal remains fell to the bottom of the vault. In order to prevent a repetition of such an accident, the coffin of the queen was opened in situ. Of the two royal personages, nothing remained but the skeletons, to which still adhered a few particles of organic matter that the embalming had preserved. Time and humidity had destroyed all the vestments in which we know they were clad. The metal alone had survived. Alongside of the king's head there was a crown; in the right hand there was a scepter; and in the left hand a globe surmounted by a cross. These three pieces of gilded copper (trumpery executed for the occasion) were almost entirely covered with verdigris. At the foot of the coffin there was a vessel of common earth containing charcoal. A few hairs still adhered to the skull. The teeth had almost entirely disappeared. The king, in fact, was seventy-one years of age on the day of his death. Isabella, on the contrary, who died at the age of forty-three, and who preceded her husband by twenty-eight years in the burial vault of Saint Maurice, still possessed nearly all her teeth. The skull had been sawed for the operation of embalming, and its cap rested upside down at the side. A few tufts of hair were still to be seen at the apex. At the feet lay the leather soles of pointed shoes, whose vamp, which was probably of fabric, no longer existed. There were no jewels nor emblems that recalled the rank of the departed.

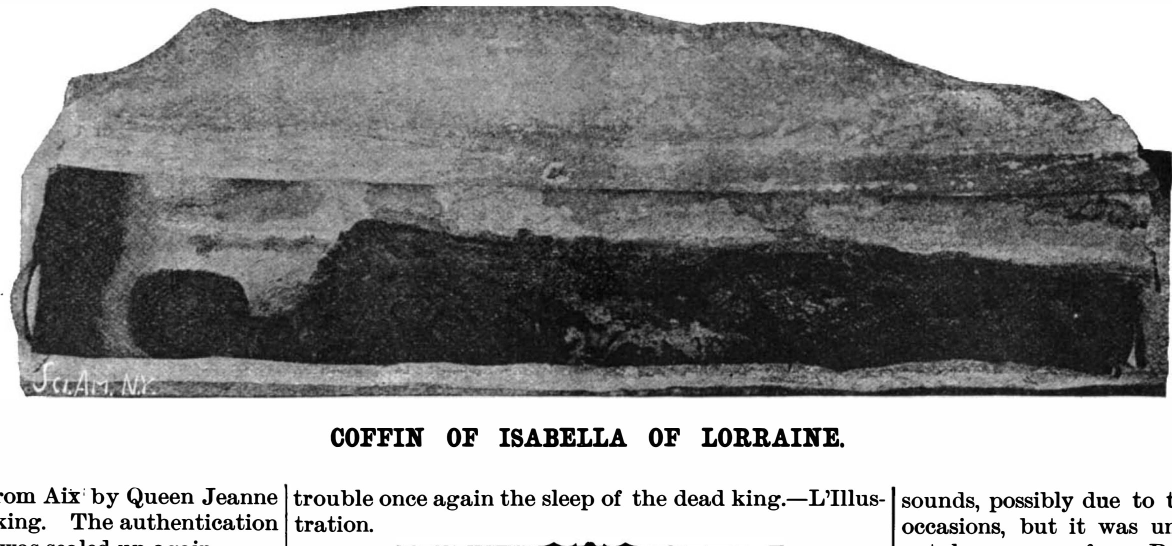
SKULL OF THE QUEEN.

SKULL OF THE KING.

Carried to a chapel of the cathedral, the remains of René and Isabella passed the night of the 16th and 17th therein. They were placed in new oaken coffins lined with lead, and to which were fixed two copper plates bearing the simple inscription: "René d'Anjou, Isabella de Lorraine." The two new coffins were then lowered to the bottom of the vault, which had been previously repaired, and in which was deposited a leaden box containing an account of the operations of June 16 and 17, in order to enlighten such future rummagers and archæologists as might be tempted to trouble once again the sleep of the dead king.—L'Illustration.



SKELETON OF KING RENÉ.



COFFIN OF ISABELLA OF LORRAINE.

PRESIDENT CLEVELAND has appointed a scientific commission to investigate the condition of the fur seals in the North Pacific and Bering Sea. The members of the commission are Mr. Jordan, of Stamford University (president), Lieutenant-Commander Moser, commanding the fish commission steamer Albatross, Dr. Stejneger and Mr. Lucas, both of the United States National Museum, and Mr. Townsend, Fish Commissioner.

The Color of the Negro Race.

The Hospital speaks as follows regarding the color of the negro race: "It has occurred to a writer in an American medical newspaper to discuss the question of the blackness of the negro's skin. It will be a revelation to many to learn that the baby negro is not born black. Even so long ago as 1765, Le Cat noticed that the newly born negro is of a reddish color. That observation has since been frequently confirmed; and it is now pretty widely known that, though the baby negro begins to follow in the footsteps of his parents as regards color within a few days after birth, yet at the moment of birth he shows a disposition to aspire toward the civilized races, being white, or, at worst, red in hue. It is generally assumed that the primest of all the causes of a negro's blackness is the hot sun beneath whose more or less vertical rays he is doomed to live. There is, however, a physiological condition of the skin which differentiates that organ from the integument of a European. 'The negro,' says our American scientist, 'possesses a more developed vascular sudoriparous system than we do.' In other words, he has more and larger sweat glands, and they are more liberally supplied with blood. By means of these he perspires much more abundantly. This condition is possibly a contributory factor in his blackness. It is an important element in the investigation to remember, however, that the blackest of all black people are almost invariably found under certain very definite climatic conditions. That is to say they are found where great heat, strong light, and much atmospheric moisture are in combination. For example, 'the blackest negroes in Africa are those who live in Guinea, where the greatest amount of rain annually falls.' On the other hand, 'the people who live in the dry section of the Nubian Desert have red skins.' Heat, light and humidity are all causes of pigmentation, and if to these we add the fact of the highly 'developed vascular sudoriparous system' of the negro, we have traveled as far as our American investigator is able to help us. The question is one of genuine scientific interest; and, perhaps, when the Matabele, and the Dervishes, and the Soudanese have all settled down quietly in the ways of civilization and order, science may turn her attention in this direction and tell us much that is both new and interesting about those races who differ so markedly from ourselves in color, character and many other particulars."

THE earth tremors and sounds produced by the Niagara Falls have been often referred to, in most cases probably with some exaggeration as regards their intensity. In a paper published in the Yale Scientific Monthly, Mr. W. H. Brewer describes some careful observations made at various times during the last forty-five years. During one year spent at Lancaster, a village twenty-seven miles from the falls, sounds, possibly due to the falls, were heard on three occasions, but it was uncertain whether they might not have come from Buffalo, which is hardly ten miles distant. The tremor observations were made within a few miles of the falls, and show that the vibrations are extremely irregular, varying both in amplitude and period. Some times they stop for an instant, then steadily increase in intensity, reaching one or several maxima, afterward steadily declining. The momentary pauses do not, however, recur at regular intervals.

RECENTLY PATENTED INVENTIONS.

Engineering.

ELEVATED RAILWAY STRUCTURE.—David D. Toal, New York City. A structure combining lightness with strength has been devised by this inventor, a series of arches instead of straight supports being used, and the structure being designed not to interfere materially with the light of stores and dwellings. The sound is deadened by laying the rails upon a lead bed, and there is a lead cushion in their under-flanged surfaces, the cushions being virtually an integral portion of the rails. The abutting ends of the rails are made with interlocking ends or tongues, and instead of the usual spikes, bolts are employed for attaching the rails to the track beams or sleepers, all the parts being of metal. It is also designed that the body of the car shall have a lead casing to deaden the sound.

Railway Appliances.

CAR FENDER.—Montgomery Queen, Brooklyn, N. Y. According to this invention the car platform is extended forwardly beyond the dashboard by sills, and the fender, which is preferably made of sheet iron, extends over the space beneath the platform and forward of the steps, shielding the latter from striking an obstruction. The front of the fender is made on the arc of a circle, but it is pointed at its forward central surface, the design being to throw to one side anything in the path of a moving car. By means of links and a drum mounted on the platform the fender is readily raised, being readily dropped to lower position by the movement of a lever, springs assisting its downward movement. The invention also provides for the employment of side fenders to prevent persons falling or being drawn under the car.

CAR FENDER.—Prentis E. Law, Santa Barbara, Cal. This improvement consists of a truck frame in front of the car and movable along the track, being adapted for lateral and vertical movement to accommodate itself to curves and inequalities, and the truck frame carrying a fender adapted to move obstructions to one side out of the path of a moving car. On the front of the fender is a buffer whose front face is inclined and normally held pressed forward by springs, and on contact with an obstruction the buffer is moved rearward and down close upon the track, breaking the force of the blow and moving the obstruction sidewise off the track.

CAR TRUCK BEARING.—William J. O'Byrne, Pontoosuc, Ill. This bearing consists of two plates adapted to be connected by bolts to the adjacent faces of the body bolster and swing beam, the plates being made cup-shaped to form small, oscillating tables with a circular retaining marginal flange, where a large metal ball is placed and is free to roll in all directions, forming a sensitive bearing between the body bolster and swing beam at each end, allowing the trucks to readily adjust and readjust themselves in all directions. As the table surfaces are flat, and the ball is not retained to any curve, the lateral swaying or lunging of the car body on curves is readily provided for.

Electrical.

OUTLET BOX FOR ELECTRIC WIRES.—Charles A. Mezger, Brooklyn, N. Y. Two patents have been granted this inventor for outlet boxes for electrical conductors and conduits, to take the place of the old form of outlet boxes, in which the box was formed with the openings to suit the particular location of the conductor or conduit, the improvement allowing an opening or openings to be readily produced at the requisite point. The box is made in two main parts or sections, joined together edgewise, and it has a number of partly or wholly completed openings in its sides and bottom wall, or a readily removable plate covers each opening, the box having openings at all convenient points. The patented devices afford convenient and reliable means for receiving and supporting the ends of electric wire conduits in wiring buildings, avoiding the necessity of providing a special box for each location, and permitting the boxes to be ordered in any required number previous to the commencement of the work. All the boxes may thus be placed in position before the plastering is commenced. These boxes are also well adapted to be placed in places formed to receive them in the finished walls of a building.

SECONDARY ELECTRIC CLOCK.—Jasper H. Wilson, Rockwood, Tenn. This invention is for a clock to be operated by an electric motor, and comprising a circuit closer within another clock, the improvement calling for but few operative parts, whereby the clock is not liable to get out of order, and may be cheaply made. Any desired number of clocks may be located in a single circuit controlled by one circuit closer, the invention being particularly adapted for use in railway stations, factories, etc. All of the clocks in a circuit are under the control of the clock in which the circuit closer is located, so that there can be no variation of the several clocks as to time.

ELECTRIC BLASTING MACHINE.—James Macbeth, Brooklyn, N. Y. This invention provides a simple and effective machine for electrically igniting charges of explo ves, the invention consisting in a dynamo electric machine mounted in a case, with the axis of its armature vertical, while combined with the armature are a propelling screw and a sliding nut. A device is provided for detaching the propelling mechanism, so that the armature may revolve by its own momentum, and there is an automatic circuit breaking mechanism. By the improved construction cog gearing and springs are avoided, and the necessary impetus is given to the armature by a simple push of the handle, interrupting the short circuit and allowing the self-induced current to flow out through the conductors connected with the binding posts, thus igniting the fuse charge.

Mechanical.

BEVELING MACHINE.—Henry M. Loud, Ausable, Mich. For quickly and accurately forming bevels at the ends of pieces of wood intended for bicycle rims, and for other similar work, this inventor has devised a machine in which is a revoluble cutter in combination with a slidable table, there being pivoted on the table a rest on which is adapted to rest the piece of wood to be beveled. The machine is of very simple and durable construction, and accurately forms the desired bevel on the wood, so that the beveled ends may be readily overlapped in forming bicycle rims and like articles.

ENGRAVER'S BLOCK.—Henry Straw, Garner, Iowa. For firmly clamping and holding articles to be engraved, this inventor has devised a simple tool that may be easily and quickly adjusted and adapted to the work in hand, comprising clamping blocks which rotate on substantially horizontal axes, and have on their several faces means to receive and hold the articles to be engraved. The block consists of a base with upwardly extended portion in which are the trunnion bearings of a ring, while a bed piece has trunnion bearings in the ring at right angles to the ring trunnions, a spring providing a yielding anchor for the trunnioned parts.

Agricultural.

CORN PLANTER ATTACHMENT.—Alfred J. Thomas, Carbondale, Kansas. This is a simple and inexpensive improvement adapted for use as a check-row marker and fertilizer dropper, the marking being effected by dropping the fertilizer, such as lime, plaster, etc., on the hills. The fertilizer is contained in a box carried on a frame attached to the axle of the planter, the box being behind the dropping devices and leaving an opening in its lower part. The opening is controlled by a valve arranged to be operated from the moving parts of the planter to drop the fertilizer on each hill, or on alternate hills, as desired.

SIEVE HOLDER.—Jefferson Tollefson, St. Ansgar, Iowa. The sieve holder and its sieves designed by this inventor are adapted for thrashing machines, etc., the tailboard being adjustable with the top sieve and the tailings sieve forming a part of and being adjustable in combination with the top separating sieve, the combined upper sieve being adjustable with the tailboard, and dispensing with the loose tailboard and tail rack ordinarily used. The adjusting devices are so connected with the sieves that the upper and under sieves are operated from different centers, the upper sieves being adjustable independent of the under sieves, and different sieves moving during adjustment to different planes.

Miscellaneous.

SCALE BEAM.—Gaylord C. Worster, Rulo, Neb. According to this invention a detachable beam is arranged parallel to the main scale beam and graduated with several horizontal series of marks for different commodities, and figured reversely to the main beam, there being a separate poise, screw stem, balance weight and hanger for the detachable beam. The scale is for use in weighing commodities where a second or tare weight is to be deducted from the first weight, the net weight being immediately indicated as soon as the tare is placed on the scale platform. The net weight is indicated both in net pounds and in bushels and fractions of a bushel, of any given weight per bushel, without any mathematical calculation.

HAT CLEANING MACHINE.—Conrad S. Schwarz, Philadelphia, Pa. A simple and easily operated machine to facilitate the cleaning of men's hats has been devised by this inventor, the machine being designed to be a great convenience in public places, as hotels, barber shops, hat stores, etc. In a table of light construction, similar to that of a sewing machine, a treadle is arranged to rotate a friction disk on the lower end of a vertical shaft which carries at its upper end a hat carrier adapted to fit and readily conform to the inside of a hat crown. The hat is placed on this carrier, which is set in rapid motion by operating the treadle, and by holding a cloth or suitable brush on the hat it will be thoroughly cleaned and brightened.

EYEGLASSES.—Franz Heilborn, Breslau, Germany. According to this improvement a perforated plate, preferably of thin sheet glass or German silver, is pivoted or hinged to the margin of the glass proper, and adapted to be swung clear of or against either the front or the rear side of the glass, the plate having a series of fine holes. The holes are preferably in concentric or radiating series, and need not be of equal sizes or distances apart. The improvement is designed to enable persons with strong myopia to read with weak glasses at a distance of about a foot, while those suffering from primary irregular astigmatism may read at the same distance without glasses.

RECEPTACLE FOR MUCILAGE, ETC.—Walter D. Gregory, Newark, N. J. For mucilage, blacking, etc., to be applied with a brush or swab, this invention provides a receptacle and a brush or swab designed to be always pliable and ready for use, and yet free from excess of liquid when not in use. The bottle or receptacle has an apertured cover through which a tubular handle of the brush projects, the brush or swab having one or more openings establishing communication between its outer or delivery end and its inner or receiving end. A cap covers the brush end projecting from the bottle when the device is not in use.

COMB.—Heinrich Traun, Hamburg, Germany. This invention provides a device for protecting the teeth of a comb, the device being formed by a bow which is rotatable, and arranged on the comb in such a manner that in one position it allows the free use of the comb, while in another position the teeth are protected against hooking in and breaking when the comb is put into a case. The comb and its protecting bow are preferably manufactured by one pressure, and the protecting bow may be applied to any kind of comb.

CUSPIDOR.—George A. Wolff, Lafayette W. Johnson, and James F. Wallace, Winslow, Arizona. This improvement is especially adapted for use in palace cars, coaches, club rooms, etc., its construction being such that when not in use it will be entirely concealed, but its gate or door will be opened by the pressure of the foot upon a knob, the cover automatically restoring itself to normal position after having been carried to one side.

FENCE STAY.—John S. Martin, Baughman, Ohio. In a fence formed of running wires, the uppermost and lowermost wires are formed with kinks bent inwardly toward the center of the fence, and these wires are connected with each other and with the other fence wires by links, thus retaining the fence wires at spaced distances apart, and allowing a limited amount of elasticity at the interlocked connections of the links with each other and with the fence wires.

PORTABLE WIRE FENCE.—James W. Hammett, Eureka, West Virginia. This invention contemplates the providing of permanent anchors about three feet underground at the corners or intersections of the fence, the anchor parts being left in the ground, so that the fence may be readily returned to its original position after it has been taken down and moved to another point. The fence strands are preferably formed in sections, the wires being secured by stays and strut braces, and a gate panel is made like any other section except that it has a bare board and a wire strut brace.

MANUFACTURE OF GLASS JARS.—Anthony Kribs, Brooklyn, N. Y. This invention provides a method whereby the mouth and neck of the article is moulded, and the body is blown in a mould. When the mouth and neck are moulded in the form of a cup, a lump of molten glass is placed in the cup to melt its bottom and sides, and the filled cup is inserted in the body mould and blown to form the body of the article from the mouth and neck.

TEMPORARY BINDER.—James A. Roberts, Chicago, Ill. This is a binder in which the sections may be conveniently adjusted to suit the work to be held. It has two sections, from one of which two rods project, the other section being slidable on these rods; the latter section has two clamping arms connected to operate as toggle links, and adapted to engage the rods and bind them against the section on which the arms are carried.

HEATING AND VENTILATING STOVE.—John D. Barrier, Mount Pleasant, N. C. This stove has double walls surrounding the fire pot, and the outlet for the discharge of the products of combustion is surrounded by a drum connected at its lower end to the space between the double walls, the upper end of the drum communicating with the air of the room and having a damper. A hot air tube extends across the fire pot and is adapted to draw air from the room. The construction is simple and inexpensive, and is designed not only to heat but to purify the air of a room.

SEWING MACHINE RIPPER ATTACHMENT.—Francis M. Batchelor, Portland, Oregon. This device is provided with a knife sliding in a slot in the apex of a peak-shaped rest secured on the top of a table resting on a sewing maching table. The knife has a straight cutting edge, parallel to which is a slot engaging a guide, and a vertically reciprocating motion is given to the knife when the needle bar is set in motion, the material advanced on the apex of the rest being then ripped or cut.

FLOORING.—Thomas Cantwell, New York City. This invention relates to hardwood or inlaid flooring, and provides for its being readily secured in place so that it will not be liable to warp. The boards have on the side a rabbet for forming a bottom flange having a transverse slot, a clamping iron passing with part of its body into the slot, while an arm extending from the body is adapted to be bent down over the board flange. No fastening devices are visible on the surface of the flooring, and the flooring boards are drawn very firmly down upon their supports, being effectively prevented from warping and longitudinal shifting.

PENCIL SHARPENER.—Henry M. Dixon, Brooklyn, N.Y. This sharpener consists of a group of knives held together by an elastic sleeve binding, the fastener being held in a tube or the barrel in which the end of the pencil is to be placed, which may also be provided with an eraser. The sharpener is reversible, and the knives are grouped together to receive the point of the pencil between them, when a quick and proper sharpening of the point of the lead may be made.

BICYCLE RIDING HABIT.—Max Diamond, Brooklyn, N. Y. This is a ladies' habit which combines skirt, trousers and leggings in one garment. The skirt and trousers are connected together at the waistband and have a divided body at the rear, where plaits extend from top to bottom of the skirt, the trousers forming an integral part of the inner edges of the plaits. The garment permits the wearer to easily mount and dismount a bicycle, the skirt not hindering the free movement of the limbs, and the garment hangs gracefully when used as an ordinary walking skirt.

SPROCKET CHAIN AND WHEEL.—James and Herbert Monks, Hartford, Conn. This improvement is especially designed for bicycles, the chain and wheel being designed to move with a minimum of friction, and the chain firmly engaging the wheel. On each pivot of the chain, and between the ends of each pair of links, are bearings, alternately arranged, one being substantially spherical and the other formed of two concentric rings, both bearings being designed to roll slightly on the face of the sprocket wheel.

SUSPENDERS.—Charles G. Mathews, Athens, Ohio. This invention consists principally of a clasp having two pivoted arms provided with spring jaws on their inner faces, the jaws being adapted to firmly engage and press the material between them. Suspenders provided with the improvement are adapted to conveniently engage and support trousers and drawers, and the suspender ends may be readily attached to the trousers when a button is torn off.

A NON-REFILLABLE BOTTLE.—William Laudahn, Port Angeles, Wash. This bottle has an auxiliary neck connected with the usual neck by a thin and easily breakable portion, the top being broken off when the bottle is to be emptied, and thus preventing the refilling and selling of the bottle as an original package. The stopper in the auxiliary neck supports a plate carrying a spring pressed pin, and a locking disk adapted to be locked with the neck has a recess receiving the pin, rendering it impossible to obtain access to the contents of the bottle without breaking off this top.

LAP BOARD.—Sophia M. Rivers, New York City. To facilitate basting and similar work, this board is made substantially in the form of a cylinder, with a cut-out portion adapting it to be conveniently held upon the lap, its inner surface being covered with some fabric or formed with ribs or corrugations. The outer face of the board is also adapted to secure a pattern upon to facilitate cutting out waists and similar garments.

ALE PUMP.—George R. and Hermann H. Neumann, New York City. In this pump an inverted U yoke is rigidly connected with the piston rod and a larger yoke embraces the other, their ends being pivotally connected together, while a lever mechanism is flexibly connected with the large yoke to reciprocate the piston rod. With this improvement the pump may be placed in any desired position or at any angle, and the piston rod operated without binding in the pump cylinder, no matter in what position the lever or equivalent operative device may be located.

MECHANICAL THEATER.—Thomas B. Thorndyke, New York City. This is a coin-operated machine, the casing representing a miniature theater building, in which is an automatically rising and falling curtain, dancing figures, music, etc., one or more figures being adapted to be moved from the wings of a miniature stage upon a movable platform on the stage floor, to cause the figures to dance upon setting the platform in motion. The dropping of a coin into a coin chute causes the unlocking of a motor, preferably in the form of clockwork, which actuates the mechanism for manipulating the dancing figures, the platform, the curtain and other parts, as well as a music box.

PREPARING DENTISTS' GOLD.—Chauncey A. Flower, New Bethlehem, Pa. Two patents have been granted this inventor for preparing gold which is especially adapted to weld or cohere into a solid filling without the use of a mallet, forming beautiful, tenacious and durable contours. The gold is heated nearly to the melting point to establish its granular form, then suddenly cooled to expand the granules and render the gold soft and cohesive, then again subjected to a heat of about 220° Fah. and gradually cooled, then again heated to 350° to 550° Fah., held at that temperature for a few minutes, and allowed to cool. One of the patents provides for plunging the gold after it comes from the annealing or tempering furnace into a bath of water charged with electricity, whereby the gold is not only changed physically by the chilling effect but it is designed that the polarity of the bath shall aid the particles in assuming the form and relation best adapted to coherence, the surface being also kept clean and bright.

MEAT BLOCK AND CHOPPING BOWL.—David H. Brannen, Fort Scott, Kansas. This block is flat on one side and concave on the other, and has legs pivoted near one edge, and reversible to project below the block when in one position but not in the other. The device may also be used as a bread board, dough raiser, etc., and may serve as a stand or table for supporting heavy articles.

PLAITING MACHINE.—Bruno Kippels and William Zeller, Moorhead, Minn. This invention relates to a machine for forming coifs such as used for neckwear by the Benedictine Sisters, the machine being a simple and inexpensive one, easily worked and effectively serving its purpose. The machine has a glass covered table over which a presser plate is held in which are slots accommodating the shanks of plungers detachably fastened to a plaiting blade. The blade is manipulated by means of handles, being raised from the fabric, pulled forward and lowered to engage the muslin or other thin goods at a point in advance of the last plait, the shoving rearward of the blade forming another plait.

Designs.

SPROCKET WHEEL.—Oscar F. Burton, Belleville, N. J. This design consists of two concentric toothed rings, one of less diameter than the other, the two rings being so close together as to appear integral. The larger rim only is connected with the hub center.

HASSOCK—William B. Shaw, Brooklyn, N.Y. The top of this hassock is of stellated form, the sides being also correspondingly shaped, and having undulations closely following the edges of the top of the hassock, while at opposite sides tabs appear extending from the top.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

F. BERGER'S FRENCH METHOD. By Francois Berger. Paris, France: F. Berger. London: D. Scott. New York: F. Berger. Pp. 158. Price 75 cents.

Professor Berger has very excellent ideas as to how French should be studied, and the following work embodies them. We believe that it will facilitate very much the learning of the French language, and the method he advises seems to be a most excellent one.

MODERN METHODS OF SEWAGE DISPOSAL. For towns, public institutions and isolated houses. By George E Waring. Second edition, revised. New York: D. Van Nostrand Company. London: Sampson Low, Marston & Company, Limited. 1896. Pp. 253. Price $2.

Mr. Waring has done such excellent work in the practical work of sewage disposal that everything relating thereto coming from his pen will be received with much appreciation. The title page shows the scope of the work, as referring particularly to a smaller class of disposal plants. A most exhaustive index gives quick reference to all the matters in the book and by its title shows how excellently selected has been the field covered by this book. Its illustrations and the printing and general make up are beyond criticism.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Minerals sent for examination should be distinctly marked or labeled.

(6922) G. F. H. says: Will you please send me by mail the formula used in preparing bird lime? A. Boil the middle bark of the holly, gathered in June or July, for 6 or 8 hours in water, until it becomes tender; then drain off the water, and place it in a pit under ground, in layers with fern, and surround it with stones. Leave it to ferment for two or three weeks, until it forms a sort of mucilage, which must be pounded in a mortar into a mass, and well rubbed between the hands, in running water, until all the refuse is worked out; then place it in an earthen vessel, and leave it for four or five days to ferment and purify itself. Remarks: Bird lime may also be made from mistletoe berries, the bark of the wayfaring tree and other vegetables, by a similar process. Should any of it stick to the hands, it may be removed by means of a little kerosene oil or turpentine. It is used to rub over twigs and leaves to catch birds or small animals, who are blinded and confused by the leaves, etc., sticking to them. The "lime" (from German "leim") indicates glue. Another preparation is made by heating linseed oil until it emits an inflammable vapor or by boiling down printer's varnish until tough and sticky; or use a solution of cabinetmaker's glue in water with addition of strong chloride of zinc solution.

(6923) W. W. L. asks (1) for complete directions for making a Ruhmkorff coil giving a ten inch spark in air. A. A coil of twice or three times the lineal dimensions of the one described in our SUPPLEMENT, No. 160, if properly constructed, should do the work. The secondary should be wound in eight or ten sections at the least, and the difficulties incident to making such a coil successfully are such that it should not be attempted by the amateur. 2. How do focusing tubes differ from Crookes tubes? A. In the shape of the cathode. A special focus tube is shown in SCIENTIFIC AMERICAN, No. 14, vol. 74. Special X ray tubes are described in our SCIENTIFIC AMERICAN, Nos. 22 and 25, vol. 74, also SUPPLEMENT, No. 1057, with notes on making.

(6924) G. C. B. writes: 1. What length spark will I obtain with a coil built similar to George Hopkins' (1½ inch spark) induction coil, but of larger dimensions? Size of coil (over all) 5×5×10¼: winding space, 1½×4¾×8¼; iron core, 1¼×9; primary coil, 3 layers of No. 16 d. c. c., secondary No. 36 inch silk wound in layers. A. All we can say is that theoretically the length of spark should vary with the 5th or 6th power of the lineal dimensions. In practice, the result will be far less favorable. It would be safer to use the 3d power. Thus a coil twice as long, wide, etc., should give a spark eight times as long. 2. Would you suggest any change in the winding (size of wire, turns, etc.)? A. Wind the secondary in six or more sections, so as to separate portions of widely varying potential. 3. Which would be better, winding the secondary in layers with a turn of oil paper between layers or win in halves as in Hopkins' coil? A. See preceding answer; wind in disk fashion. 4. Have you published any notes in the SCIENTIFIC AMERICAN or the SUPPLEMENT upon apparatus for producing the X rays? Please give number of issue and subject of articles. A. Exhaustive data on this subject will be found in SCIENTIFIC AMERICAN, Nos. 7, 10, 12, and 14, vol. 74, also SUPPLEMENT, Nos. 1050, 1054, 1055, 1056, 1057, 1058, 1065, 1067, 1068, and 1069. These articles give practical directions for taking the pictures, apparatus necessary, etc.; they also treat on the physical questions involved. You may anticipate much trouble in building so large a coil. Try smaller ones first. Disappointment in results is to be anticipated.

(6925) H. A. H. asks: 1. What is the best and simplest method for polishing mahogany and holly inlaid veneers? A. For polishing veneers, we refer you to the following books: "The Hardwood Finisher," by Hodgson, price $1; "The French Polisher's Manual," price 20 cents, postpaid. 2. Is the indicated coil for alternating currents described in SCIENTIFIC AMERICAN of March 11, 1893, suitable for producing X rays, using a T. H. alternating dynamo, with 12 field coils, and running at 1,500 revolutions per minute, as a source of current? Would the alternations be rapid enough? A. Yes. Probably it would be well to omit the Leyden jars. 3. Could above coil be used to excite a Crookes tube, if built on smaller scale? A. It could be made much smaller, but should be based on giving at least 200,000 volts. Give enough turns in secondary, when divided by turns in primary, to produce a multiplier which, multiplying the original voltage, would give 200,000. 4. Would it be possible to secure an index to Notes and Queries for the last six or seven volumes? Do you know of any subscriber to SCIENTIFIC AMERICAN who has one? A. Possibly some of our subscribers may answer this query.

(6926) J. J. O'D. asks: 1. By what process can melted lead be reduced to powder? A. Heat the lead, and when just melted pour into a wooden bread tray well chalked on the inside. Throw it into the air and catch it, and repeat this until it has solidified. It will then be in fine granulated form (test lead). 2. Also what process will convert litharge back to metallic lead? A. Heat with powdered charcoal and sodium carbonate (dry).

(6927) J. C. M. says: Do you know of anything that will cure sweaty hands? Hands that perspire so that the perspiration will drop off them when it is warm. A. When perspiration is excessive it may be regulated by using as a wash, once a day, not oftener, for about two minutes, liquor atropiæ, 2 drachms; water, 1 pint. The face and other parts may also be washed as often as desired with alum, 1 ounce; glycerine, 1 ounce; water, 10 ounces.

(6928) R. H. F. asks: Please explain the difference between a tornado and a cyclone, and the atmospheric disturbance. A. The tornado is a sudden outburst of wind in an otherwise quiet, sultry atmosphere; it is ushered in by a loud, indescribable roar, similar to a continuous roll of thunder; its path is very narrow—seldom more than 500 feet wide at greatest destruction; it moves, generally, from southwest to northeast, and rarely extends more than twenty miles; it very often rises in the air, to descend again at a point a few miles ahead; it is always accompanied by thunderstorms, with often a bright glow in the cloud; this cloud has usually a funnel shape, which appears to be whirling, though some observers have described its appearance like that of a huge ball rolling forward. A tornado may be considered as the result of an extreme development of conditions which otherwise produce thunderstorms. A cyclone, on the other hand, is a very broad storm, often times 1,000 miles in diameter, and sometimes can be followed half around the world; the winds circulate about it from right to left, or the way one turns clock hands backward (in the southern hemisphere this motion is reversed). The air pressure always falls as one approaches the center, where, at sea, there is a portentous calm, with clear sky visible at times. The cyclone winds often rise to hurricane force, but are not to be compared with the extreme violence of the tornado, before which the most solid structures are razed. The French term trombe or tourbillon describes almost exactly the tornado, which term was first applied to severe squalls, with funnel-shaped clouds, experienced on the west coast of Africa, and which, to this day, inspire the utmost fear in the minds of the natives. This is supplied by the chief of the Weather Bureau.

(6929) J. W. P. says: Can you give me some information regarding pyrocatechin as a photographic developer? A. Pyrocatechin is said to possess the following advantages as a developer: Its delicacy is equal to pyrogallol; the solution only alters very slowly on exposure to air, and is much more stable than hydroquinone, eikonogen, etc. The color of negatives is very favorable to printing, which proceeds more rapidly than with other developers. It gives brilliant prints without hardness. It does not fog the plates. It does not stain the fingers. The same bath will develop several plates. The following are the principal solutions: Solution A: Water, 1 ounce; sodium sulphite, 20 grains; pyrocatechin, 10 grains. Solution B: Water, 1 ounce; potassium carbonate, 100 grains. For use in ordinary exposures, equal parts of A, B, and water. For under-exposed plates, take one part A to two parts B. For plates that have had a timed exposure, the following one solution developer is recommended: Water, 2 ounces; sodium sulphite, 25 grains; sodium carbonate, 50 grains; pyrocatechin, 10 grains. To bring out contrasts, a two per cent boric acid solution is recommended instead of bromide.

(6930) A. E. G. asks how to remove bichromate stains from the hand. A. Pour a little solution of sulphurous acid on to your hands. On rubbing the fingers the stains rapidly bleach. Subsequent washing with rain or distilled water would be preferable; but ordinary water will answer. Or take a warm, strong solution of hyposulphite of soda, and add thereto a small quantity of ordinary sulphuric acid. The same bleaching action as with sulphurous acid will take place.

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INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

July 28, 1896,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Advertising device, F. J. Langer ... 564,704
Air brake, street car, D. Beemer ... 564,863
Annunciator, C. C. Gould ... 564,746
Antiseptic salts, impregnating fabrics with, H. R. Hirschler ... 564,928
Ash pan or receptacle, M. M. Koch ... 563,754, 564,755
Axle box, car, A. A. Weber ... 564,856
Bag making and packaging machine, H. E. Smyser ... 564,722
Bearing, thrust, J. Gilbert ... 564,609
Bed bottom, spring, A. Cole ... 564,869
Bed, folding, W. J. Pyle ... 564,644
Bedstead, spring, W. M. Jones ... 564,621
Bench. See Work bench.
Bicycle frame, J. G. Leyner ... 564,627
Bicycle gearing, P. N. Stover ... 564,948
Bicycle handle bar, P. W. Stevens ... 564,848
Bicycle hub, J. R. Kennedy ... 564,697, 564,698
Bicycle lock, S. G. Kell ... 564,623
Bicycle pump, J. F. Braun ... 564,736
Bicycle riding habit, M. Diamond ... 564,822
Bicycle stand, W. H. Hart, Jr ... 564,787
Bicycle supporting stand, W. N. Beardsley ... 564,733
Bicycle wrench, G. K. Kelsea ... 564,625
Bicycles, mechanical movement for, H. Tuttle ... 564,665
Binder, temporary, F. A. Bradley ... 564,819
Binder, temporary, J. A. Roberts ... 564,650
Block. See Meat block.
Board. See Drawing board. Lap board.
Boiler. See Vertical boiler. Wash boiler.
Boiler tube cleaner, J. L. Lockhart ... 564,932
Book covers, etc., means and appliance connected with, W. Symons ... 564,659
Book holder, W. D. Cave ... 564,779
Book holder, S. B. Fuller ... 564,608
Bottle, L. C. Werner ... 564,673
Bottle closure, W. Laudahn ... 564,826
Bottle filling apparatus, Bowie & Dodd ... 564,735
Bottle, non-refillable, D. Landstra ... 564,895
Bottle stopper, H. P. & S. L. Barnhart ... 564,732
Box. See Axle box. Feed box. Journal box. Musical box. Paper box.
Box fastener, C. Tollner ... 564,661
Bracelet fastening, R. Senner ... 564,654
Brake. See Air brake. Car brake. Vehicle brake. Velocipede brake.
Brooder, chicken, E. F. Hodgson ... 564,689
Brush holder, folding, M. J. De Lent ... 564,739
Button, H. Kerngood ... 564,890
Button backs, machine for making, F. J. Ludington ... 564,828
Button fastener, H. Kerngood ... 564,888
Calendar for pencils, etc., G. W. Johnston ... 564,885
Cam, sectional, Ravenscroft & Magnusson ... 564,841
Cam, machine for manufacturing multiple throw, J. Price ... 564,800
Camera, photographic, G. P. Parradee ... 564,838
Can filler, H. Nutter ... 564,637
Car brake, electric, A. W. Mitchell ... 564,632
Car coupling, P. Schreiber ... 564,768
Car fender, P. B. Donahoo ... 564,599
Car fender, C. F. Jahn ... 564,692
Car fender, P. E. Law ... 564,827
Car fender, M. Queen ... 564,645
Car motor, street, T. D. Hoskins ... 564,618
Car shade adjuster, E. W. Smith ... 564,903
Car step and platform guard, combined, D. R. Wing ... 564,675
Car track switch, street, C. R. Osborne ... 564,837
Car wheel forging machine, J. A. Facer ... 564,603
Cars, automatic door release for dump, W. W. Stoney et al ... 564,805
Cars, hoisting and unloading railway, P. Rasch ... 564,646
Card shuffling apparatus, F. L. Becker ... 564,774
Carding engines, means for fastening card clothing to flats of revolving flat, R. W. Hunton ... 564,691
Carpet sweeper, S. H. Raymond ... 564,647, 564,648
Carriage, child's, A. Woodward ... 564,678
Cattle guard, H. N. Whitcomb ... 564,809
Case. See Egg case.
Cash register and indicator, J. P. Cleal ... 564,738
Chain and wheel, sprocket, J. & H. Monks ... 564,830
Chain, drive, V. H. Perry ... 564,760
Chair, F. F. Fortney ... 564,744
Cigar roller's clamp, E. M. Hyslop ... 564,751
Clamp. See Cigar roller's clamp.
Clasp. See Dental plate clasp.
Clip for display of price cards, I. H. Peck ... 564,799
Clock, secondary electric, J. H. Wilson ... 564,811
Clothes pounder, G. Kint ... 564,892
Clothes wringer, Searles & Shirley ... 564,653
Coffee mill actuating mechanism, J. B. Frem ... 564,606
Colcothar, manufacture of, M. N. d'Andria ... 564,731
Collar fastener, horse, J. C. Weinman ... 564,671
Combing machines, automatic stop motion for wool, Berwick & Hadfield ... 564,912
Cores in molding flasks, anchoring, Lobdell & Tolmie ... 564,896
Corn cutter, green, N. C. McCown ... 564,832
Corn huskers and feed cutters, shredding device for, W. Gutenkunst ... 564,747
Coupling. See Car coupling. Thill coupling.
Crane, overhead traveling, W. H. Morgan ... 564,708
Crate, knockdown, A. Phelps ... 564,713
Culm loader, A. H. Roberts ... 564,937
Current generator, alternating, B. G. Lamme ... 564,702, 564,703
Curtain fixture, C. Matthews ... 564,630
Curtain guide, E. T. Burrowes ... 564,682
Cutter. See Corn cutter. Vegetable cutter.
Dental plate clasp, W. S. Elliott ... 564,600
Dentists' gold, preparing, C. A. Flower ... 564,877, 564,919
Diaphanie, R. Grimme ... 564,613
Die head, open, H. Kupsch ... 564,700
Display card for exhibiting materials for dress, etc., B. Nichols ... 564,836
Display stand for bills of fare, H. J. Geer ... 564,785
Distilling apparatus, self regulating, S. L. Bigelow ... 564,734
Door opening apparatus, K. Gerstmann ... 564,880
Doors or window sashes, construction of, H. A. Cordray ... 564,780
Draught regulating mechanism, automatic, W. E. Nageborn ... 564,935
Draught rigging, W. Case ... 564,867
Drawing board, J. O. Poole ... 564,840
Dredgers and excavators, dipper tooth for steam, Trim & Pryor ... 564,664
Drier. See Lumber drier.
Drilling machine, Fritz & Boby ... 564,879
Dye, greenish blue, T. Sandmeyer ... 564,801
Dyeing apparatus, C. A. Hunt, Jr ... 564,619
Egg case, M. E. Chamberlain ... 564,914
Electric accumulators, paste carrying plate for, F. W. Schneider ... 564,652
Electric current regulator and distributer, A. H. Washburn ... 564,951
Electric machine and electric motor, dynamo, Elliott & Eskholme ... 564,743
Electric motor support, S. H. Short ... 564,902
Electric transformer, F. L. Sessions ... 564,944
Elevator apparatus, hydraulic, H. C. Johnson ... 564,620
Elevator locking mechanism, A. C. Hunt ... 564,884
Elevators and elevator doors, safety locking device for, J. D. Conner ... 564,956
Engine. See Gas engine. Gas or oil engine. Internal combustion engine.
Engine igniter, explosive, T. G. Cantrell ... 564,737
Engine igniting device, gas, A. J. Pierce ... 564,642
Engraver's ruling machine, Nouel & Martini ... 564,636
Excavator, H. R. Keithley ... 564,695, 564,696
Excavator and conveyer, combined, J. J. Trainor ... 564,727
Eyelets, device for making covered, A. C. Estabrook ... 564,602
Faucet, oil can, G. W. Arper (reissue) ... 11,560
Feed box, Hermany & Snead ... 564,788
Feed regulating and measuring apparatus, E. E. Hollister ... 564,929
Feeding and exercising chickens, apparatus for, M. Stewart, Jr ... 564,849
Fence, Clune & Eckel ... 564,591
Fence, N. Fryman ... 564,607
Fence, J. H. Whisler ... 564,857
Filter, J. A. Bowden ... 564,776
Filter, G. H. Sellers ... 564,943
Filter press, B. Remmers ... 564,715
Fire extinguisher, T. F. Handly ... 564,615
Fireproof floor or roof, A. G. Eastman ... 564,783
Fish bait, artificial, E. F. Pflueger ... 564,839
Fishing rod, F. K. Dunn ... 564,742
Flooring, T. Cantwell ... 564,820
Fodder compress and binder, J. L. Ashbaugh ... 564,910
Folding table, N. O'Brien ... 564,711
Fruit holding pocket, T. S. Fitch ... 564,605
Fruit packer, D. H. Gould ... 564,881
Furnace. See Hot air furnace. Smoke consuming furnace.
Furnaces, apparatus for feeding bagasse, J. Fisher ... 564,918
Furnaces, nozzle for injecting steam into, W. L. Denio ... 564,873
Gage. See Pressure gage.
Garment fastener, W. Janisch ... 564,693
Gas engine, A. J. Pierce ... 564,643
Gas machines, air forcing device for, J. H. Graf ... 564,786
Gas mixing device, E. N. Dickerson ... 564,684
Gas or oil engine, H. Swain ... 564,769
Gas, producing, E. Thomson ... 564,806
Gate. See Swinging gate.
Gate, Witherell & Eldridge ... 564,676
Generator. See current generator.
Glass jars, manufacture of, A. Kribs ... 564,825
Glass or lens for spectacles or folders, L. Kokocinski ... 564,894
Golf club, E. Slade ... 564,655
Grain binder, W. W. Burson ... 564,589
Grain binder knotter operating mechanism, M. Kane ... 564,622
Grain elevators, guide for tackel of, C. T. Ladd ... 564,701
Gramophone, E. Berliner ... 564,586
Grate, C. J. Bonnet ... 564,864
Grater, J. S. Sobey ... 564,656
Gum, paste, etc., apparatus for containing and applying, L. Gunn ... 564,614
Gynecological stirrup, J. Snodgrass ... 564,947
Hair curler, A. S. Gilmore ... 564,611
Handle. See Pot handle.
Harrow and cultivator, B. L. McLendon ... 564,833
Harvester, J. F. Steward ... 564,724
Harvester, corn, J. C. Culbertson ... 564,872
Hay rake, horse, W. H. Traphagen ... 564,663
Head rest, W. W. Dirksen ... 564,874
Heating greenhouses, plant for, E. N. & D. B. Kroninger ... 564,756
Hook. See Singletree hook.
Hook and eye, F. A. Decker ... 564,821
Hose washer, E. T. Slaght ... 564,720
Hot air furnace, H. C. Steinhoff ... 564,804
Ice chest and crate, combined, L. O. Read ... 564,764
Ice plants, can filler for artificial, L. Schimke ... 564,651
Index and alphabetical record, general, G. C. Ward ... 564,670
Inhaler, E. D. Martin ... 564,628
Internal combustion engine, J. Saltar, Jr ... 564,766
Journal box for shafts or axles, metal ball bearing, F. G. Wilson ... 564,860
Knitting machine, J. Johnson ... 564,886
Ladle operating mechanism, H. Aiken ... 564,770
Lamp, bicycle, W. S. Hamm ... 564,882
Lamp, central draught oil, J. H. Ross ... 564,718
Lamp cut out, arc, A. H. Lucas ... 564,757
Lamp, electric arc, W. C. Armstrong ... 564,771, 564,772
Lamp, electric arc, B. B. Ward ... 564,907
Lamp fitting, incandescent electric, E. F. A. Soleau ... 564,723
Lamp, incandescent, H. Zerning ... 564,952
Lantern, W. E. Penchard ... 564,759
Lantern, D. C. Pryor ... 564,762
Lantern, bicycle, W. Trabue ... 564,662
Lap board, S. M. Rivers ... 564,843
Lasting machine, S. W. Ladd ... 564,931
Leather forming or moulding machine, Perry & Gordon ... 564,641
Leather shoe laces, machine for cutting, E. Rahm ... 564,899
Letter posting and stamping machine, coin fed, freed, D. di B. Savorgnan ... 564,845
Life buoy, G. H. C. Brunswig ... 564,778
Linoleum or other floor cloths, machine for making inlaid, W. G. Thomson ... 564,853
Lock. See Bicycle lock. Master key pin lock. Sash lock.
Lock and latch, P. J. Conroy ... 564,915
Locomotive, electric rack, D. L. Barnes ... 564,861
Lumber drier, L. A. Parisher ... 564,639
Master key pin lock, H. R. Stadtmuller ... 564,803
Measuring machine, cloth, J. Darling ... 564,596
Meat block and chopping bowl, D. H. Brannen ... 564,913
Metal planing machine attachment, J. R. Willard ... 564,810
Metal polishing machine, T. L. Wallace ... 564,668
Metal separator, electric, Whitacre & Wolfe ... 564,858, 564,859
Metal working apparatus, electric, H. Lemp ... 564,792
Milk, process of and apparatus for sterilizing, E. Taulis ... 564,851
Mill. See Windmill.
Mining machine, F. M. Lechner ... 564,705
Mining machine, G. F. Myers ... 564,758
Motor. See Car motor.
Musical box, J. Billon-Haller ... 564,775
Musical performers, support for, Vinbruex & Sobinski ... 564,667
Nail setting machine, Wright & Carmichael ... 564,815
Nozzle, sprinkling, C. F. Van Camp ... 564,906
Nut lock, J. C. Holloway ... 564,750
Oiler, floor, J. MacKenzie ... 564,707
Oven, portable bake, Ludwick & Amborn ... 564,798
Packing for piston and valve rods, metallic, E. J. Armstrong ... 564,953
Packing, steam, J. Yates ... 564,908
Paint, resurfacing, E. N. Schultz ... 564,901
Pan. See Ash pan.
Paper box, J. T. Craw ... 564,592, 564,593
Paper box, knockdown, J. T. Craw ... 564,594
Paper, fixture for holding roll, O. H. Hicks ... 554,688
Paper hanger's folding table, R. G. Odell ... 564,936
Paper holder, roll, E. Morgan ... 564,633
Pen, fountain, C. J. Renz ... 564,842
Pen, fountain, A. J. Scritchfield ... 564,938
Pencil sharpener, H. M. Dixon ... 564,823
Petroleum, process of and apparatus for refining Lima or similar, H. Frasch ... 564,922, 564,924
Petroleum, purifying, H. Frasch ... 564,921
Petroleum purifying apparatus, H. Frasch ... 564,920
Petroleum, refining Lima or similar, H. Frasch ... 564,923
Photographer's refining stove, D. R. Van Riper ... 564,729
Picker. See Fruit picker.
Plaiting machine, Kippels & Zeller ... 564,893
Planter, corn, H. E. Fairchild ... 564,604
Planter, corn, A. A. Stinchcomb ... 564,658
Planter, cultivator and harrow, combined, M. B. Gooing ... 564,612
Planters, field anchor for check row corn, A. McDonald ... 564,710
Plating, nickel, H. L. Haas ... 564,748
Pot handle, L. E. Vacheron ... 564,728
Pottery moulding machine, J. A. Zengler ... 564,680
Power wheel, F. Kline ... 564,790
Preserving apparatus, food, A. Ernecke ... 564,601
Press. See Filter press. Printing press.
Pressure gage, F. Hart ... 564,957
Printing press, S. R. Kramer ... 564,626
Propulsion of canal boats, electrical, A. C. Mather ... 564,629
Pulley, M. W. Jamieson ... 564,752
Pump, J. C. Wilson ... 564,674
Pump, ale, G. K. & H. H. Neumann ... 564,834
Pump, centrifugal, C. McIntyre ... 564,934
Pump, centrifugal, F. Orton ... 564,897
Puzzle, A. E. Schmidt ... 564,846
Rack. See Shoe rack.
Rafter support, D. M. Rothenberger ... 564,844
Rail holder, guard, G. Ehrhart ... 564,876
Railway, E. M. Boynton ... 564,865
Railway cattle guard, Goldrick & Vogl ... 564,685
Railway signal, electric, W. Daves ... 564,683
Railway structure, elevated, D. D. Toal ... 564,854
Railway switch, I. A. Allen ... 564,909
Railway switch, H. C. Derr ... 564,916
Railway track layer, R. Behrends ... 564,585
Rake. See Hay rake.
Recorder. See Time recorder.
Refrigerator, W. A. H. Schonefeld ... 564,719
Refrigerator car, Thomas & Truby ... 564,660
Register. See Cash register.
Rolling mill platform, W. Davies ... 564,597
Rowlock for boats, W. H. Taylor ... 564,725
Ruling machine, paper, R. H. Welch ... 564,672
Saccharin, making, C. Fahlberg ... 564,784
Saddletree, G. Theobald ... 564,726
Sand moulding machine, A. B. Kilpatrick ... 564,8[illegible]
Sandpapering machine, W. Black ... 564,5[illegible]7
Sandpapering machine, F. Peterson ... 564,7[illegible]2
Sash holder, W. F. Johnston ... 564,[illegible]94
Sash holder and fastener, E. A. Worthen ... 564,[illegible]13
Sash lock, F. W. Woychinske et al ... 564,814
Sash, window, P. E. Loree ... 564,933
Saw, H. C. Barbee ... 564,582
Sawmill carriage offsetting device, W. O. Carlson ... 564,866
Saw set, J. A. Morrell ... 564,634
Seal, metallic envelop, Dennis & Bramberg ... 564,781
Separator. See Metal separator.
Sewing machine feeding mechanism, J. C. Keough ... 564,887
Sewing machine pad stitching attachment, P. Diehl ... 564,598
Sewing machine ripping attachment, F. M. Batchelor ... 564,818

Sewing machine thread waxing device, C. P. Holmes 564,883
Shades, guide for spring actuated, R. P. Smith 564,721
Shaft, crank, F. C. Holmes 564,958
Shaft, flexible, E. L. Doyen 564,875
Sheet metal articles, means for repairing punctured, M. A. Stone 564,850
Shirt waist, A. H. Graftey 564,925
Shoe, J. H. Preble 564,714
Shoe, W. Schneider 564,767
Shoe rack, J. J. Rhodes 564,716
Shutter operating and locking device, A. Velt 564,807
Sleeve holder, J. Tollefson 564,855
Signal. See Railway signal.
Signaling apparatus, P. Lupke 564,706
Singletree hook, J. E. Brennelsen 561,954
Skirt holder, K. D. Head 564,687
Smoke consuming furnace, F. J. Reinisch 564,649
Soap, electrical, H. E. Rider 564,717
Soap, fluorescent, S. Neumann 564,835
Sound locating instrument, D. P. Heap 564,926
Speaking tube, W. Perpente 564,898
Spindle, E. Tweedale et al 564,905
Spinning spindle, cap, J. W. Bamford 564,773
Spring fastener, S. Porter 564,761
Sprinkler. See Water sprinkler.
Stair step cover, D. Walker 564,739
Stand. See Bicycle stand. Display stand.
Stereotype plate holder, C. C. Keller 564,624
Stopper. See Bottle stopper.
Stove, air tight heating, W. M. Milburn 564,631
Stove and grate, B. Woodhull 564,677
Stove, gas, T. A. Bryan 564,681
Stove, heating and ventilating, J. D. Barrier 564,817
Stud, clasp, H. Kerngood 564,839
Suspenders, C. G. Mathews 564,829
Swinging gate, Copeland & Nesmith 564,870
Switch. See Car track switch. Railway switch. Trolley track switch.
Switchboard back connection, A. J. Wurts 564,679
Table. See Folding table.
Telephone system, C. C. Gould 564,745
Theater, mechanical, T. B. Thorndyke 564,853
Thill coupling, E. A. Benner 564,911
Thrashing machine grain delivery, M. Rumley 564,765
Ticket, price, J. T. Hopkins 564,930
Time recorder, watchman's, K. Muller 561,709
Tire for vehicle wheels, pneumatic, C. K. Welch 564,808
Tire, inflatable, A. Pulbrook 564,763
Tire scraper, bicycle, G. A. Mylacraine 564,831
Tire shrinker, W. Hullerman 564,690
Tires, evacuating device for pneumatic, H. A. Veazie 564,666
Tongue support, wagon, J. H. Cassidy 564,590
Toy egg, Gottschalk & Sipe 564,686
Toy team of horses, H. C. Ives 564,789
Trocar, S. E. Baker 564,581
Trolley, D. Lippy et al ..... 564,793 to 564,795
Trolley carrier and hanger, W. J. Sumner 564,949
Trolley finder, H. Ogborn 564,638
Trolley track and hanger, L. Coburn 564,868
Trolley track switch and bracket, W. J. Sumner 564,950
Trolley wheels, yielding and self adjusting support for, Brunswick & Johnson 564,955
Trough. See Watering trough.
Truck, car, H. Tesseyman 564,904
Truck corner iron, E. Dietz 564,740
Typewriting machine, G. W. Hall 564,749
Typewriting machine platen shift, W. P. Kidder 564,699
Valve, engine, H. R. Fay 564,917
Valve, safety, F. N. Winne 564,812
Valve, thermostatic, M. Leitch 564,791
Vegetable cutter, grater, and dish drainer, F. B. Cunningham 564,595
Vehicle brake, J. E. & J. G. Walton 564,669
Vehicle, motor, C. H. Barrows 564,584
Velocipede, R. S. Lovelace 564,797
Velocipede brake, G. Baxter 564,862
Velocipede seat, H. J. Burgess 564,588
Velocipede steering head, F. K. Dunn 564,741
Velocipedes, device for varying the speed of, W. T. Harder 564,617
Velocipedes, variable speed gearing for, W. T. Harder 564,616
Vending machine, Cravens & McGoodwin 564,871
Vending machines, coin detector for automatic, A. Jaeger 564,824
Vertical boiler, Patzelt & Schoche 564,640
Wagon and velocipede, combined child's, Long & Shull 564,796
Washboiler, L. W. Boynton 564,777
Washing apparatus, portable, M. Frisch 564,878
Water closet seat, H. B. Riggs 564,900
Water closet seat and hinge, J. Barrett 564,583
Water, purifying, G. H. Sellers 564,940
Water purifying apparatus, G. H. Sellers, 564,939, 564,941, 564,942
Water sprinkler, E. R. Gill 564,610
Water sterilizing apparatus, H. G. Stiebel, Jr 564,657
Water trough, North & Stake 564,635
Weighing apparatus, B. Simons 564,945
Weighing machine, automatic, B. Simons 564,946
Wheel. See Power wheel.
Wheel rim, wooden, H. G. Shepard 564,802
Windmill, J. W. Henry 564,927
Wood, etc., tool for working, P. Jury et al 564,753
Work bench and tool box, combination, T. E. Doelger 564,782
Wrench. See Bicycle wrench.
Wrench, Aldrich & Chamberlin 564,816
Wringer. See Clothes wringer.

DESIGNS.

Bell case, electric, E. G. Worley 25,842
Boiler lug, H. B. Butler 25,846
Buckle, C. S. Comstock 25,831
Cabinet, waiter's, M. A. Coman 25,847
Electrical muffle casing, L. E. Custer 25,843
Eyelet, E. Kempshall ..... 25,832 to 25,835
Foot rest, G. W. Yearicks 25,848
Gas lights, gallery for incandescent, W. E. Barrows 25,844, 25,845
Hood, M. Dubinsky et al 25,849
Hook, lacing, E. Kempshall 25,836, 25,837
Meat tenderer, M. E. Bonte 25,841
Opera glass holder, B. H. Blank 25,838
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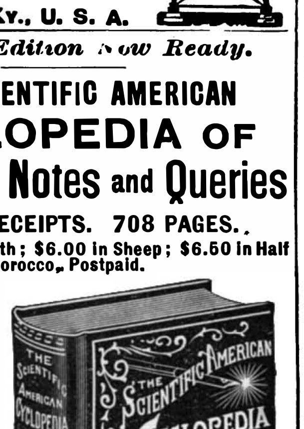

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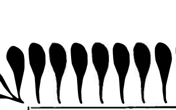

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